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1883	"	63	" "	1890	"	289	" "
1884	"	82	" "	1891	"	325	" "
1885	"	100	" "	1892	"	316	" "
1886	"	138	" "	1893	"	317	" "
1887	"	154	" "				

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Electricity and Type Setting. FOR some timee the larger type in the reading pages of THE ELECTRICAL WORLD has been set up by type-setting machines run by lec ric motors. The experience in this line has been so satisfactory that commencing with this number the smaller type at the end of the reading matter will also be set in the same manner. A marked advantage of this method is that the type is always new in every issue, the machine molding each line as it is set. The present limits of the machine prevent the use of full-faced type or italics as formerly, but doubtless even this will be overcome before long. In the meantime it will be seen that we have substituted for the full-face side headings formerly used on the paragraphs side heads of what printers call roman caps.

Progress a Hindrance in Germany. IN the city of Stuttgart, Germany, the municipal fathers have just decided to postpone the erection of a central station for five years, on the grounds that valuable improvements may be made during that time! If these same men, who are doubtless already quite well advanced in years, should live to be five years older, and if it should then still be the misfortune of that city to be governed by them, which is not unlikely in Germany where such positions are next to hereditary, they will, if consistent, doubtless come to the same conclusion again, and so on for periods of five years, until the wise precaution of nature, to relieve this world of useless beings has enabled other and more progressive men to take their place.

Lacombe vs. Lacombe. SHOULD the Curiosities of Incandescent Lamp Litigation ever be written, and for such a book there is already abundant material, the chapter relating to the proceedings in the United States Circuit Court in this city last week will not be the least interesting. As will be seen in another column, where the remarks of Judge Lacombe are reported in full, the important point developed lies in the expression of the Court's views in regard to the bearing of a certain clause in the decision of the Circuit Court of Appeals of Dec. 19, 1892, affirming Judge Wallace's decision sustaining the Edison incandescent lamp patent. The object of this clause (which we reprint elsewhere) was to protect, it has been supposed, the owners of electric light apparatus purchased prior to July 19, 1892, in case of refusal on the part of the Edison company to sell them lamps. Any other interpretation seems out of the question, yet Judge Lacombe, who signed the order containing the clause, now intimates that if the Edison company does not choose to sell lamps to those who are defined in the clause, it need not do so; furthermore, if it chooses, it need not sell lamps to any one. Following this line of argument it is implied that the defendants have no cause of complaint, as the plaintiffs merely "refused to sell you lamps; that is all"! The judge intimated that if the refusal should be conditioned by a demand to purchase other apparatus, then the court might step in and interfere, but, it may be asked, Why should the clause be considered to apply to this case and not to one to which no condition whatever is attached? That an appellate court will sustain such a view of the clause in question is unlikely, and it is even a matter of doubt if Judge Lacombe himself will abide by his offhand interpretation when the question comes before him for formal decision.

A Bright, Brainy Editor. IN the columns of one of our contemporaries last week—that one which has earned a reputation for the acuteness of its vision at long range and the profundity of its *ex post facto* prophecies—appears an editorial on the Oconto lamp decision that challenges our admiration. Whenever that contemporary does print anything really meritorious, we are always glad to give it publicity in our columns, for it seems a pity that genuine worth, however humble its origin, should go unrecognized and unrewarded. The kernel of the profound truth there enunciated is contained in this sentence: "If this element of doubt could have been eliminated from the history of lamp No. 4; if, for instance, it could have been identified as a lamp which had actually been burned for a reasonable period; and if it could also have been proved with sufficient certainty to have been in existence before 1879, *the overthrow of the Edison patent would*, IN OUR OPINION, *have been inevitable*." Isn't that grand? But what a pity our contemporary did not suggest this to Messrs. Witter and Kenyon before the trial! How simple it all seems, now that our attention is called to it! But, still, isn't this conclusion a little rash for our contemporary—ought it not to have gone a step further and said that if in addition to proving that lamp No. 4 was made and constantly used by Goebel prior to 1879, it could also have been proved that Edison never had a patent on an incandescent lamp, and that the Oconto people never made or sold or intended to make or sell an incandescent lamp, then, in its opinion, the injunction would have been denied? Would not this have been safer? We merely throw this out as a friendly hint to our usually cautious contemporary. It is really very humorous in its way to find technical journals giving the opinion of a judge in a certain case—in some instances copied from the local daily paper—and solemnly commenting upon it, when not a word of the evidence upon which the case was decided has appeared in their columns. The views of these journals in such cases are usually about as valuable as those we have quoted; and when the editor tries to impress upon his readers how very "enterprising" the paper has been in the matter, his efforts are particularly amusing. Had THE ELECTRICAL WORLD not reported the proceedings in the Columbia case and in the Oconto case—and it was the only paper of any kind that did—the electrical fraternity would have had considerable difficulty in understanding intelligently the important questions involved.

English Electric Traction Regulations. SEVERAL weeks ago we referred editorially to the battle in England between the telephone and the electric railway, and we are happy to learn that victory rests where it should—with the electric railway. The new government regulations, while more restrictive than would perhaps be considered necessary in the United States, are yet distinctly favorable to the cause of electric traction, and should go a long way toward accelerating the electric street railway industry in Great Britain. The National Telephone Company instituted the proceedings before a Parliamentary committee in order to prohibit electric street railways from using any other than an insulated return, but the new rules permit the use of an insulated return conductor of low resistance; as in any case regard must be paid to the effect of the expense on the commercial prospects of the undertaking, this no doubt will be taken to qualify the "low resistance." It is also stated that "It is not, in the present state of electrical science, to the interest of the public to insist upon electrical tramways using an insulated return conductor." It is required that all reasonable precautions shall be taken not to injuriously affect, by fusion or electrolytic action, any gas or water pipes or other metallic pipes, structures or substances, being evidently assumed that this can be practically done by choice of a proper resistance for the return conductor. The same reasonable precautions are to be taken to avoid interference with other electric circuits, and these precautions will be held to have been taken so long as insulated returns or uninsulated returns of low resistances are used in accordance with rules of the Board of Trade. A further provision is that after a certain period (two years are suggested) no action can be taken against an electric street railway to protect any electric line unless it uses a metallic return, which effectually disposes of the earth return monopoly of the telephone and telegraph companies. With this considerate treatment of a new industry, fisticuffs in the House of Commons and a socialistic body governing London, it verily seems that British conservatism is becoming a thing of the past.

The Expiration of the Edison Lamp Patent. IN another column are collected the various facts bearing upon the date of expiration of the Edison incandescent lamp patent, from which it appears that a decision of the United States Supreme Court alone will definitely fix that date. Of the three main legal points not yet settled by a final decision of that court, two are given little weight. A third one, however, in regard to whether the date of application or the date of issue of an American patent shall prevail in determining priority of date with reference to foreign patents, rests upon a more debatable basis, notwithstanding the unanimity of the lower United States courts in deciding in favor of the date of issue. The first point of law is as to whether the life of an American patent issued subsequent to a foreign patent will be limited by the life of the foreign patent if the patentee is an American citizen. This has been decided in the lower United States courts in the affirmative, and no weight seems to be attached to the negative contention. The second point of law is in regard to which of the three dates on the English patent which expires Nov. 10, 1893, shall prevail. There have been several decisions on this question, and all have been in favor of one or the other of two dates; both of these in the case of the Edison patent are subsequent to the American date of issue, and therefore do not affect the American life of the patent. Owing, however, to the Edison patent attorneys in an indorsement on the American patent wrongly designating Nov. 10, 1879, as the date of the English patent, which is previous to the date of the American patent (Jan. 27, 1880), it may be contended in court that the date thus given should hold and consequently the American patent expire with the English one on Nov. 10, 1893. It is not thought, however, that there is any hope of maintaining this point, particularly as a court has declared the indorsement in question void, the Commissioner of Patents having exceeded his authority in admitting it. The third point, to which we referred first, has strong equities in favor of the date of application, besides one or more points of law. Those who hold this view contend that it is unjust that the American patentee should have his home patent limited in life by a foreign patent because a foreign patent office has been more expeditious than the American one. The applicant has absolutely no control over the date of issue in any case, and should the English patent issue prior to the American one, the life of the latter is only fourteen years, instead of seventeen when the American patent is first issued. As in all foreign patent offices the time is almost always less between the date of application and the date of issue, the effect of the law as interpreted by the lower courts is to deny a patentee a life of seventeen years to his domestic patent if he should also take out foreign patents—a state of affairs surely never contemplated by the framers of the statute thus construed. Notwithstanding that all of the decisions of the lower United States courts have been against accepting the date of application, it is held by many that if the same courts were not bound by their previous decisions they would decide differently at the present time; this, it is asserted, has been indicated by expressions from the bench and by the fact that the United States Supreme Court has reversed the lower courts in other questions of law under the same statute. While it is thus not at all certain that the Edison patent will expire with the Canadian patent on Nov. 19, 1894, yet the chances that the United States Supreme Court will overrule the point of law repeatedly and unanimously affirmed by lower courts has the odds largely against it.

The Expiration of the Edison Lamp Patent.

The recent decision in Milwaukee in the Oconto incandescent lamp case has caused renewed interest to be taken as to the probable date of expiration of the Edison incandescent lamp patent, in regard to which there is some difference of opinion. The views of former counsel on either side during the lamp litigation between the United States and Edison companies have been obtained by The Electrical World, from which it appears that the questions at issue are well defined. The most important of these issues, if not the only important one—that relating to whether the date of the application for a patent or the date of issue shall prevail—will come up for final decision in the United States Supreme Court this winter.

There are three definite points of law relating to the Edison incandescent lamp patent, it is learned, which have not yet been passed upon by the United States Supreme Court in all of their details, though all three have been decided by lower United States courts. One of these is whether the limitation of an American patent by the life of a foreign patent granted previous to the American one applies to foreigners alone or also includes Americans; the law of the lower courts at present is that the statute makes no distinction between foreign and domestic patents. Neither of the eminent counsel seen appears to regard this issue as of any great weight.

Another point of law is in regard to the date of the English Edison patent. The English patent, which had 14 years to run, is actually dated Nov. 10, 1879, and as this date is prior to that of the American patent (Jan. 27, 1880) it would seem that the latter should expire with the English patent, on Nov. 10, 1893. The lower United States courts have, however, agreed in deciding in similar cases relating to English patents that the date which shall prevail with reference to the statute of limitation is not the date of filing the provisional specification, Nov. 10, 1879, in the present case; the decisions conflict as to the date to apply, whether that when the complete specifications are filed (Feb. 6, 1880) or when the great seal is attached (May 10, 1880); as both of these latter dates are subsequent to the date of the American patent, the expiration of the English patent does not affect the American one. It seems, however, that after the American patent was granted the Edison attorneys had attached to it a statement limiting the life of the patent to that of the foreign one having the shortest life; among the foreign patents enumerated is the English patent, to which the date Nov. 10, 1879, was given in the statement. In the subsequent lamp litigation this point was brought forward, but the court decided that the statement was void on account of the Commissioner of Patents having no authority to make an indorsement on a patent after it was granted, and that the courts would determine for themselves the questions and dates relating to the application of limitations. Neither counsel seems to attach much weight to this point.

The third and most important point of law is in regard to whether the date of issue of the American patent or that of application is to apply in relation to the date of the foreign patent. In the present instance there is but one foreign patent that might naturally shorten the life of the American patent—that granted in Canada, on Nov. 19, 1879, which will expire Nov. 19, 1894. The application for the American patent was filed Nov. 4, 1879, but was not granted until Jan. 27, 1880. If, therefore, the date of application prevails, the American patent antedates all foreign ones, and will not expire until Jan. 27, 1897; if, on the other hand, the date of granting the patent is the vital one, the patent will expire with the Canadian one on Nov. 19, 1894.

The former counsel of the United States Electric Lighting Company states that this point of law has been passed upon a number of times by the United States lower courts, and the decisions are unanimous that the date of issue of an American patent, and not the date of application, is the one to be applied; that in the recent Faure battery decision (July 18) Judge Coxe again upheld this view, and there is no reason to believe that this great unanimity of opinion will be reversed by the United States Supreme Court.

On the other hand, the counsel for the other side states that the prospect of a reversal of the lower courts by the Supreme Court is favorable, and that several other interpretations by these courts of the same statute have already been thus reversed. He also stated that it is very noticeable that the lower courts have a different opinion in regard to the interpretation of that point of the statute at present than formerly, but that they can now scarcely do otherwise than follow the law they have laid down. A strong argument for reversal is the manifest injustice of the present law. When an inventor files his patent he loses all control over it and of course of the date of issue; as, besides, foreign patents are usually issued much more quickly than American ones, the consequence is that injury, which the inventor is powerless to avert, is almost certain to be done. Among the legal points against the statute is one that the bar which is interpreted to apply to a patent issued subsequent to the foreign one was not intended to be applied as it has been, but was inserted to cover another issue.

Electrical Symbols and Nomenclature.

The following communication has been addressed by Drs. Bedell and Crehore to Mr. A. E. Kennelly, member of the Committee on Provisional Programme, appointed by the American Institute of Electrical Engineers for the World's Congress of Electricians.

Sir:—In accordance with the suggestion made by you in a recent conversation on the subject of electric symbols and nomenclature, the system of notation given below has been tabulated by us and is offered as possibly including some material which might be incorporated into a uniform international system of terminology and abbreviation which will doubtless come up for discussion at the World's Congress of Electricians near at hand. The carefully worked-out scheme of M. Hospitalier is a valuable foundation for a suitable system, and the following table has been made upon it as a basis, in conformity with it in the main, with such amendments and additions as seem advisable. In order that a comparison with the proposal of M. Hospitalier may be the more readily made, his system has been placed in a parallel column with the one now suggested

Physical quantities.	Symbols.	Defining equations.	System of M. Hospitalier.
Fundamental.			
Length	L, l, r		L, l
Mass	M		M
Time			T, t
— definite period	T		—
— independent variable	t		—
Geometric.			
Surface area	A	$A = L^2$	$S = L.L$
Volume	V	$V = L^3$	$V = L.L.L$
Angle	a, θ, φ	$\alpha = \frac{\text{arc}}{\text{radius}}$	$\alpha = \frac{\text{arc}}{\text{radius}}$
Number of windings	S		N
Mechanical.			
Velocity	v	$v = \frac{l}{T}$	$v = \frac{L}{T}$
Angular velocity	ω	$\omega = \frac{v}{r}$	$\omega = \frac{v}{L}$
Acceleration	a	$a = \frac{v}{T}$	$A = \frac{v}{T}$
Force	F	$F = M.a$	$F = M.A$
Work	W	$W = F.l$	$W = F.L$
Power	P	$P = \frac{W}{T}$	$P = \frac{W}{T}$
Pressure	p	$p = \frac{F}{A}$	$p = \frac{F}{S}$
Moment of couple	(?)	$= F.l$	$W = F.L$
Moment of inertia	K	$K = M.l^2$	$K = M.L^2$
Magnetic.			
Strength of a pole	m	$F = \frac{m.m'}{r^2}$	$F = \frac{m^2}{L^2}$
Magnetic moment	$\mathfrak{M}$	$\mathfrak{M} = m.l$	$\mathfrak{M} = m.l$
Intensity of magnetization	$\mathfrak{I}$	$\mathfrak{I} = \frac{\mathfrak{M}}{V}$	$\mathfrak{I} = \frac{\mathfrak{M}}{V}$
Field intensity		—	$H = \frac{F}{m}$
Flux of magnetic force		—	$\Phi = H.S$
Magnetizing force—constant value	H	$\mathsf{H} = \frac{4\pi SI}{l}$	$\mathfrak{H} = \frac{4\pi NI}{L}$
— maximum value when varying harmonically	H		—
— instantaneous value	h		—
— sq. root of mean sq. value	$\overline{\mathsf{H}}$		—
Magnetomotive force—constant value	F	$\mathsf{F} = \mathsf{H}l = 4\pi SI^*$	$\mathfrak{F} = 4\pi NI$
— maximum value when varying harmonically	F		—
— instantaneous value	f		—
— sq. root of mean sq. value	$\overline{\mathsf{F}}$		—
Magnetic susceptibility	κ	$\kappa = \frac{\mathfrak{I}}{\mathsf{H}}$	$\kappa = \frac{\mathfrak{I}}{\mathfrak{H}}$
Magnetic permeability	μ	$\mu = \frac{\mathsf{B}}{\mathsf{H}}$	$\mu = \frac{\mathfrak{B}}{\mathfrak{H}}$
Specific magnetic resistance (*reluctivity*)	ρ	$\rho = \frac{1}{\mu}$	$\rho = \frac{1}{\mu}$
Magnetic resistance (*reluctance*)	$\mathfrak{R}$	$\mathfrak{R} = \frac{l}{A\mu}$	$\mathfrak{R} = \rho\frac{L}{S}$
Magnetic induction—constant value	B	$\mathsf{B} = \mu\mathsf{H}$	$\mathfrak{B} = \mu\mathfrak{H}$
— maximum value when varying harmonically	B		—
— instantaneous value	b		—
— sq. root of mean sq. value	$\overline{\mathsf{B}}$		—
Total induction	N	$N = \mathsf{B}A\dagger$	—
Electromagnetic.			
Resistance	R	$R = \frac{E}{I}$	$R = \frac{E}{I}$
Equivalent resistance	R'		—
Electromotive force — constant value	E	$E = RI$	$E = RI$
— maximum value when varying harmonically	E		—
— instantaneous value	e		—
— sq. root of mean sq. value	$\overline{E}$		—
Difference of potential	—	—	$e = \frac{R}{I}$
Intensity of current — constant value	I	$I = \frac{E}{R}$	$I = \frac{E}{R}$
— maximum value when varying harmonically	I		—
— instantaneous value	i		—
— sq. root of mean sq. value	$\overline{I}$		—
Quantity of electricity—constant value	Q	$Q = IT$	$Q = IT$
— maximum value when varing harmonically	Q		—
— instantaneous value	q		—
— sq. root of mean sq. value	$\overline{Q}$		—
Capacity	C	$C = \frac{Q}{E}$	$C = \frac{Q}{E}$
Equivalent capacity	C'		—
Electric energy	W	$W\ddagger = EIT$	$W = EIT$
Electric power	P	$P\S = EI$	$P = EI$
Resistivity	(?)	$= \frac{A}{l}R$	$\alpha = \frac{RS}{L}$
Conductance	(?)	$= \frac{1}{R}$	$= \frac{1}{R}$
Specific conductivity	(?)	$= \frac{l}{AR}$	$= \frac{1}{\alpha}$
Coefficient of self-induction	L	$L = \frac{N}{I}$	$L_s = \frac{\Phi}{I}$
Coefficient of equivalent self-induction	L'		—
Coefficient of mutual induction	M		L_m

* More strictly: $\mathbf{F} = \int \mathbf{H} \cdot d\mathbf{l}$

† More strictly: $N = \int \mathbf{B} \cdot d\mathbf{A}$.

‡ More strictly: $dw = e\,i\,dt$.

§ More strictly: $P = \frac{dw}{dt}$.

Dashes indicate that symbols are lacking in one system or the other. An interrogation mark (?) has been used to indicate that a symbol is desired. The distinction between maximum values, instantaneous values, and square root of mean square values, thus, E, e, $\overline{E}$, etc, seems called for in alternating current literature.

Suitable terms for the resistance, real and apparent, in an alternating current circuit would be extremely desirable; thus:

$$\sqrt{R^2 + \left(\frac{1}{C\omega} - L\omega\right)^2} = \text{impediment};$$

$$\sqrt{R^2 + L^2\omega^2} = \text{impedance};$$

$$R = \text{resistance};$$

$$L\omega = \text{inductance};$$

$$\frac{1}{C\omega} = \text{condensance}.$$

All of these quantities have the dimensions of a resistance and may be expressed in ohms. For the last two quantities, $L\omega$ and $\frac{1}{C\omega}$, suggestive names, as "inductance" and "condensance" are particularly necessary, the terms "inductance speed" and "capacity-speed-reciprocal," already used, being quite cumbersome.

The use of n to denote frequency is already common and may well be retained. For the quantity $\omega = 2\pi n$ one word, as "rotation" or "rotivity," is needed to take the place of the two "angular velocity."

In conclusion, we would suggest that the word "virtual" be always used to denote the square root of the mean square value of any varying quantity, and that the "effective electromotive force" be used to denote that component of the "impressed electromotive force" which is effective in overcoming ohmic resistance.

Frederick Bedell,
Albert C. Crehore.

Cornell University, July 21, 1893.

In the scheme given above we have used Gothic letters for vector or directed quantities. M. Hospitalier has since explained to us that he does not consider it advisable to introduce this distinction, taking the ground that, inasmuch as the exact nature of all physical quantities is not sufficiently understood to enable a proper distinction to be made in all cases, it would block further progress in this direction to try to introduce this distinction at present. It is, however, open to question whether it is not well to retain the start which has already been made in this direction. The word "reactance," which he has suggested for $\frac{1}{C\omega} - L\omega$, may well be adopted as indicating the presence of a reacting force which is not present in resistance.

F. B.
July 29, 1893. A. C. C.

International Electrical Congress Appointments.

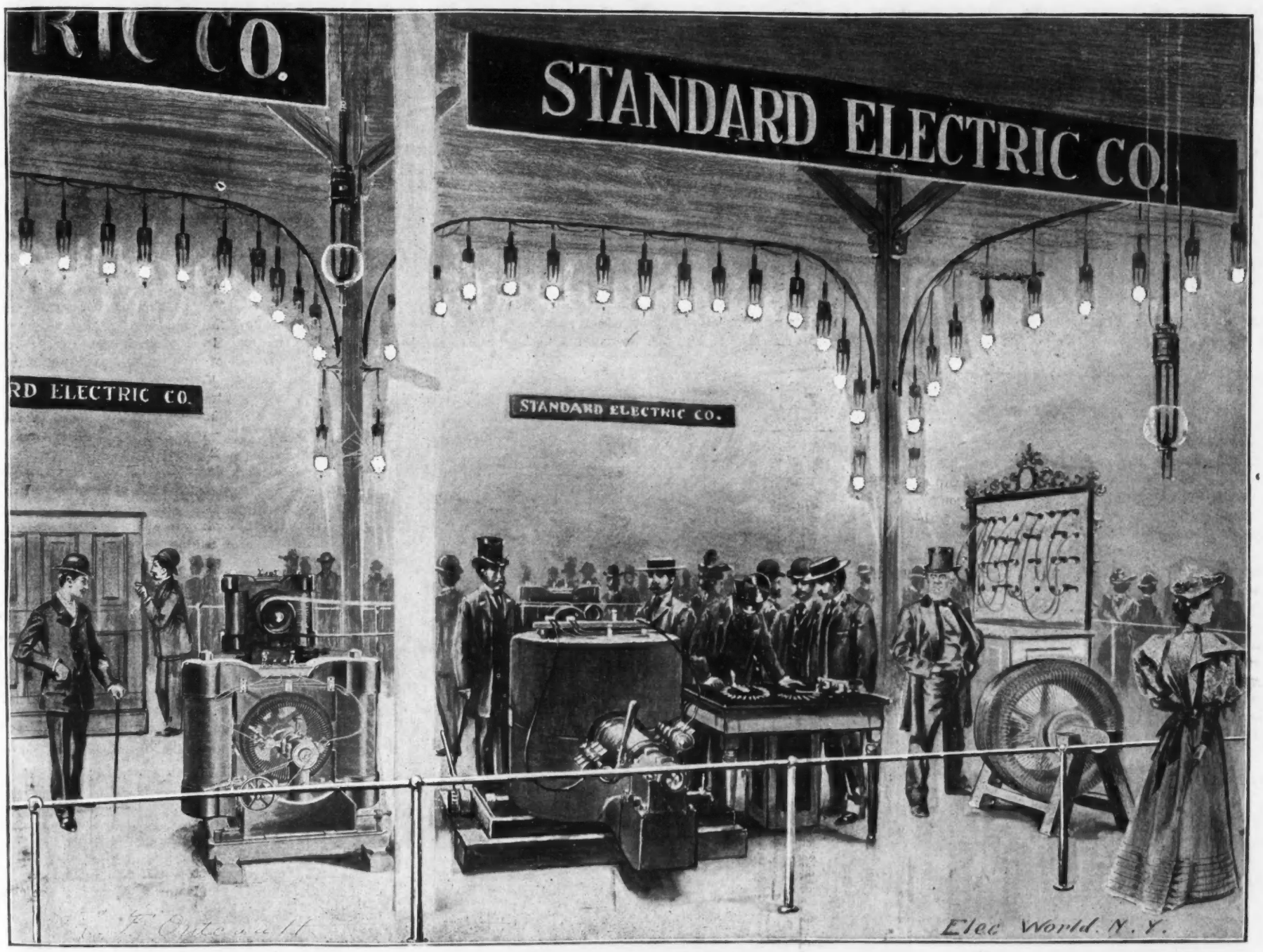
The Elektrotechnischer Verein of Vienna has appointed the following members to the Chicago Electrical Congress: Nikola Tesla, A. Prosch, Ernst Egger, Dr. Johann Sahulka, Fred W. Tischendorfer and Joseph Wetzler.

IN ELECTRICITY BUILDING AT THE WORLD'S FAIR

THE EXHIBIT OF THE STANDARD ELECTRIC COMPANY.

The Standard Electric Company have one of the most prominent locations on the ground floor of Electricity Building, adjoining the west entrance. Here they have displayed samples of various sizes of arc light machines, arc light hangers and arc lamps, which form the specialties of this company.

They were organized in the spring of 1891, and the wares of the company are already known throughout the United States, and have made a reputation such as none but first-class apparatus could have made. The company make the claim that the first machine ever constructed in their shops is in practical operation today, and that they have yet to have a case of failure on the part of their apparatus.



AN INTERESTING EXHIBIT.

The arc light machines, which are of the series winding, of the Manchester constant pole type, with Gramme ring armature. This is wound with No. 15 wire on a laminated core of No. 27 sheet iron, built up on twelve insulated steel bolts, supported on a spider at one end, leaving the opposite or commutator end free and open. A feature of the pole pieces is that the consequent poles are separated by a magnetic gap, which is thought to give greater uniformity of action and less distortion than the continuous magnetic pole piece usually employed in the consequent pole construction. The controlling apparatus is entirely magnetic, and is what has become known as the Sperry controller. It consists simply of an iron lever centrally pivoted on one side of the armature between the two horns of the opposite poles, and which is attracted against a coiled spring through a greater or less vertical angle, thereby shifting, by means of a simple rod mechanism, the brushes back and forth on the commutator as the demands in the circuit increase or decrease. This apparatus, simple as it is, is exceedingly effective, and it is claimed by the company to give better control, all things considered, than any other apparatus on the market. As an illustration of its rapidity in action those in charge are pleased to short circuit a number of lamps, and this is done without any sparking or apparent disturbance or strain on the apparatus.

One of the greatest features of merit and popularity of the Standard dynamo is the great facility with which all of its parts may be reached. The armature itself may be removed by simply unscrewing four bolts and removing first the two bearings. The armature may then be withdrawn from either side, which in cramped positions is a matter the importance of which will be greatly appreciated by those having machines necessarily so situated. The radiating surface of the armature is exceedingly large; larger than that of any other machine now on the market, it is claimed. This insures cool working, even when operated beyond its rated capacity. The bearings are self-oiling, and the boxes are made of gun metal set with babbitt and have ball bearings.

The different sizes of constant current arc machines manufactured by this company are all displayed, and one of them is in more or less constant operation, furnishing current to rows of arc lamps, which form another feature of this interesting display. Since prime motors are not allowed in Electricity Building, this company obtain current for their arc lamps from a 100-h. p. 500-volt constant potential machine in Machinery Hall. This current operates a 40-h. p. Rockford iron-clad motor, to which is belted by a Monarch belt from the Bradford Belting Company, of Cincinnati, O., a 50-light, 9.6-ampere machine. In addition to this there are exhibited a 40-light, 8-ampere machine; a 30-light, 9.6-ampere; a 20-light, 9.6-ampere machine, and a 50-light 6.3-ampere machine. The 50-light, 9.6-ampere machine, as above stated, is employed to operate the 56 arc lamps here displayed. It also furnishes current at times to all of the other machines, which are operated as motors. Of the 56 arc lamps displayed, 50 of them are single-service and six are double-service lamps. All of the double-service lamps are single carbons. These single-carbon, double-service lamps employ oval or elliptical carbons made especially for the Standard double-service lamp. The advantages claimed for this elliptical carbon are, that it has simplified the all-night lamp by doing away with one extra rod and the double mechanism.

The dimensions of the carbons used for this purpose are 7-16 by 14-16 inch by 12 inches. These carbons will run continuously for fourteen hours. A larger carbon is also provided intended for sixteen hours' service, and this is ½ inch by 1 inch in sectional area. The company propose to adapt these same carbons to shorter service lamps, and have already made experiments to that end, and have decided upon the following dimensions: 6-16 by 12-16 by 12 inches for ten hours' service; 5-16 by 10-16 by 12 inches for eight hours' service. A material advantage is claimed for these carbons in addition to the greater length of life which they have over the usual shaped carbons in that a more continuous arc is maintained. To demonstrate this, they have erected in their space a handsome oak cabinet, in which has been hung an arc lamp employing the elliptical carbons, so situated that the arc is in front of a lens, which throws an image of the arc upon a canvas screen enabling it to be studied without injury to the eye through a circular aperture in one end of the cabinet. By applying the eye to the peep-hole one may watch the progress of the arc from one side of the carbon to the other and back again,

and notice the regularity of the feed of the lamp. This is a novel and effective way of advertising the merits of a carbon or of an arc lamp.

Some of the lamps are attached to automatic lamp hangers and cut-outs, by which when the lamp is trimmed it is cut out of circuit, and the circuit is closed in the act of lowering, thus rendering danger to the trimmer impossible. Another convenience for the trimmer is the arrangement by which the globe can be removed when desired without the removal of a single screw.

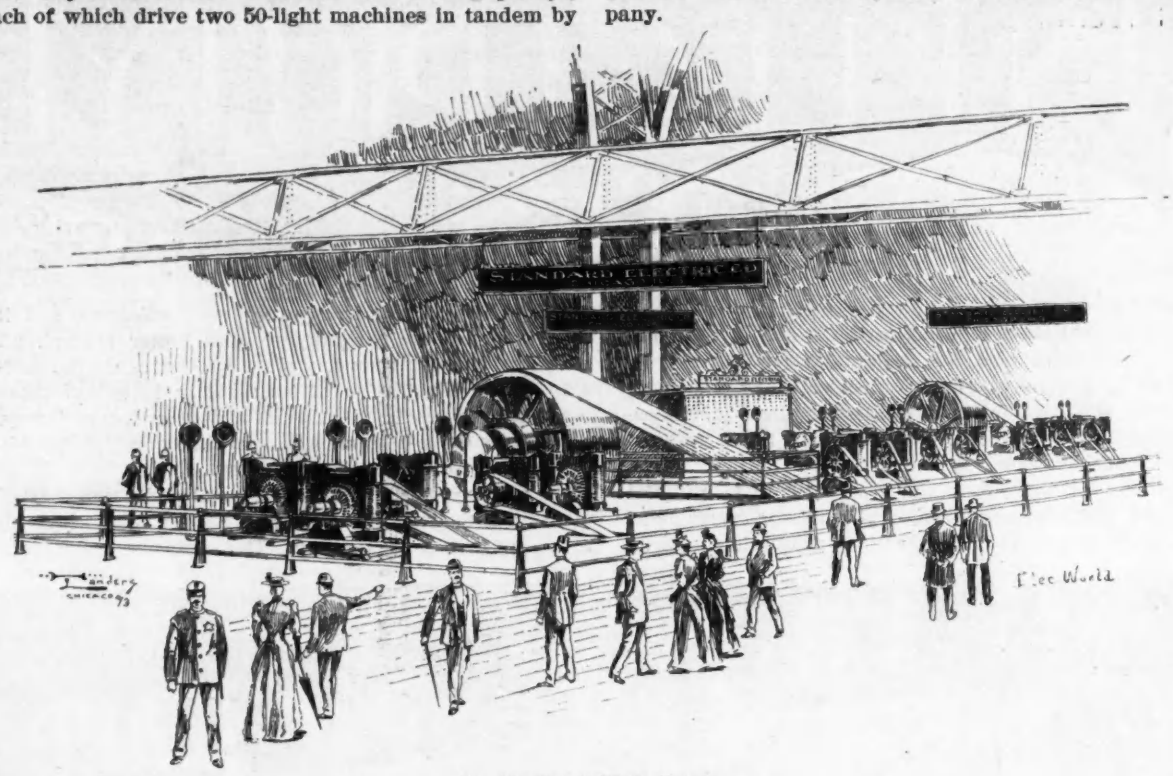
The double-service, weather-proof lamp for outside use is rendered weather-proof by inclosing the terminal wires and switch in telescope cast iron boxes placed on top of the mechanism chamber. This requires neither hook nor specially designed hanger, as each lamp is provided with an insulated hanger suitable for hanging on a swivel hook, which is easily placed wherever the lamp is desired.

Another form of hanger exhibited here is the Utica hanger, which was recently adopted by the city of Cincinnati and employed by the Cincinnati Edison Electric Light Company, which obtained the franchise for municipal lighting, and which closed a contract with the Standard company for machines to furnish 2,500 arc lamps.

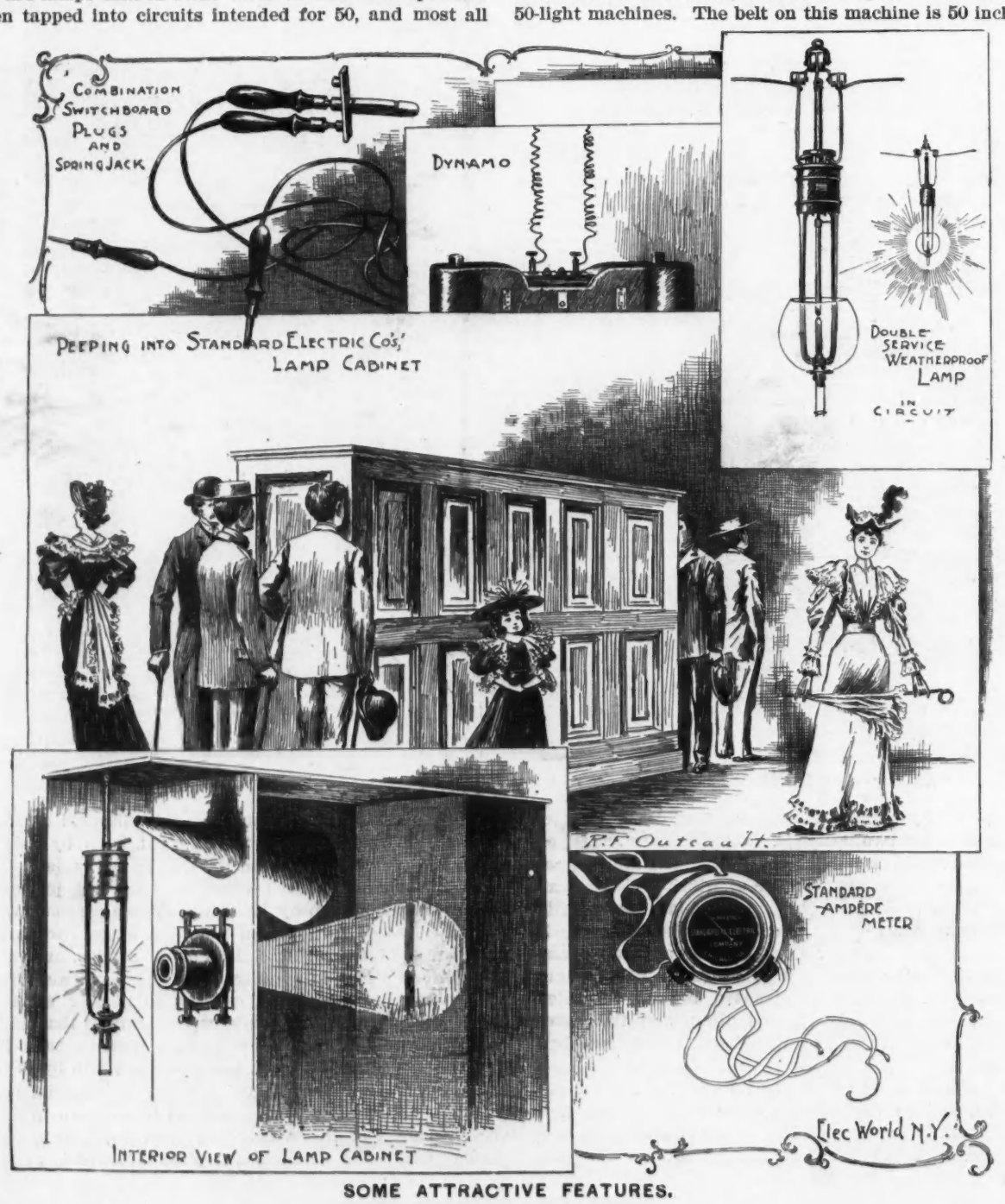
In addition to the four arc lamps suspended from the various forms of hangers before referred to, three sides of the space are closed in, as it were, by lines of arc lamps suspended from metallic arches, and which, when illuminated, make the space of the Standard Electric Company one of the most brilliant on the floor of Electricity Building.

THE STANDARD ELECTRIC COMPANY'S EXHIBIT IN MACHINERY HALL.

But the largest exhibit of the Standard Electric Company is found in Machinery Hall, near the south end, where their service plant for the Exposition is installed, consisting of 20 50-light arc machines, applying current to lamps in the Agricultural Building, Shoe and Leather Building, Machinery Hall, and in various places throughout the grounds. Here in the evening one may see all of these machines in motion, but operated beyond their rated capacity. In fact, so great has the demand been for arc lamps that in some cases 75 and 80 lamps have been tapped into circuits intended for 50, and most all of the circuits are, in fact, called upon to do more than was ever contemplated. So great has been this increased demand that additional machines of the same make have been installed in odd places in Machinery Hall, but of these we shall make no further mention. The twenty machines above referred to are arranged in two parallel rows between the aisle and the south side of the building, and are driven as follows: Beginning at the south end there is stationed a 15 by 14 inch engine running at 275 revolutions, furnished by the Erie City Iron Works. This has two driving pulleys, each of which drive two 50-light machines in tandem by means of George Oberne & Co.'s belts. Next north is a Russell compound engine with cylinders of 13 inches and 20 inches in diameter, and 20½ inches stroke. This is belted to a countershaft, and belted from the latter are four 50-light machines. Adjoining this is a pair of Russell right and left engines, each having two cylinders of 15 and 24 inches in diameter and 24-inch stroke driving a common shaft. The latter is belted to a countershaft, from which again are driven 12 50-light machines. The belt on this machine is 50 inches wide. Both of these Russell machines are belted to a countershaft beneath the floor, whence the belts of the separate generators come out at their appropriate places to the separate machines. All of the belts used on the Russell engines in this plant and the dynamos driven by them are of the George Oberne & Co. make. In the centre of the space is a small switchboard by which the 20 engines are controlled. This board is unpretentious and unobtrusive, and is simple and effective and in keeping in this respect with all of the apparatus manufactured by the Standard Electric Company.



IN MACHINERY HALL.


COMBINATION SWITCHBOARD PLUGS AND SPRING JACK
DYNAMO
DOUBLE SERVICE WEATHERPROOF LAMP IN CIRCUIT
PEEPING INTO STANDARD ELECTRIC CO'S' LAMP CABINET
R.F. Outcault.
STANDARD AMPÈRE METER
INTERIOR VIEW OF LAMP CABINET
Elec World N.Y.

SOME ATTRACTIVE FEATURES.

The New York Insulated Wire Company and the Standard Paint Company occupy a space in the southeast gallery, and for purposes of convenience, will be considered together, as the two companies occupy the extreme south end of the raised platform to the east of the well.

NEW YORK INSULATED WIRE COMPANY.

The space of the New York Isulated Wire Company is L shaped, that of the Standard Paint Company filling out the section. In the foot ofthe L are arranged seven pyramids of five spools each, of Raven White Core and flexible Grimshaw wires in different styles of finish. The central pyramid of the seven differs from the others in this, that it is composed of four spools of stranded copper wire, tinned and set upon a pedestal in lieu of the fifth spool. This pedestal is surrounded by tubes of Vulca ducts, arranged vertically, which form a strong contrast with the brilliant silvery appearance of the tinned cables above. This central pyramid is the only one showing wire without the insulation. In this exhibit cables are shown, varying in size from 400,000 circular mils to No. 18 B. & S.

In the southwest corner of the space is a handsome brass easel, whose standards are twisted in imitation of cables. Upon this rests an oak sample board covered with sections of cables and wires, and samples of Grimshaw white and black tape. A little to the north of this is another similar brass easel, with oak sample board, showing cables in lengths and sections tastefully arranged. Between the two, and parallel with the aisle, is another handsome polished brass easel supporting a large black plate glass sign with letters in gilt, as follows:

NEW YORK INSULATED WIRE COMPANY,
Sole Manufacturers
Grimshaw White Core wires,
Raven Core wire, Competition wire,
Grimshaw tapes, Grimshaw compounds,
New York, Chicago, Boston and San Francisco.

This is an exceedingly handsome specimen of the sign-maker's art. Upon the floor beneath it and resting upon the easel is a photograph of the office of Bagnell & Hilles, 42 Yokohoma, Japan, the Japanese representatives of the New York Insulated Wire Company.

Quite near to this is still another easel of twisted brass, supporting an oak board, upon which has been reproduced in metal and cables the well known trademark of the Grimshaw wires. The central disc is of burnished copper. Surrounding this is a zone of White Core wire in white, upon which the words, "White Core" are outlined in letters of tin, and surrounding this is another zone, composed of insulated wire in black, upon which have been placed in letters of tin the words "Grimshaw" above, and "Insulated Wire" below. Facing to the northwest is another brass rod easel bearing a plate glass sign, black, with gilt letters, similar to the other plate glass sign in size and shape; upon this are the words:

NEW YORK INSULATED WIRE COMPANY,
Sole Manufacturers
Vulca Electrical Wire Ducts,
New York, Chicago, Boston and San Francisco.

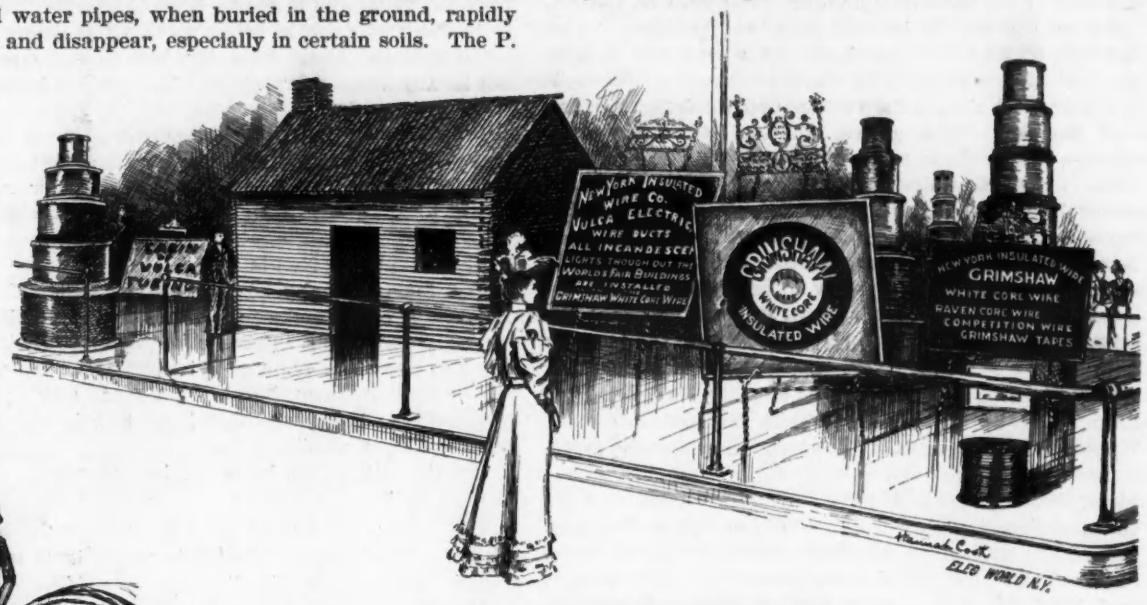
The additional information that all the incandescent lighting circuits throughout the World's Fair buildings are installed with Grimshaw White Core wire, is also to be found here.

The most unique display in this space, however, is that of the Vulca electrical wire ducts, which have been fashioned into a small log cabin, covering an area of 10 by 4 feet. The ducts themselves are the logs, and the usual

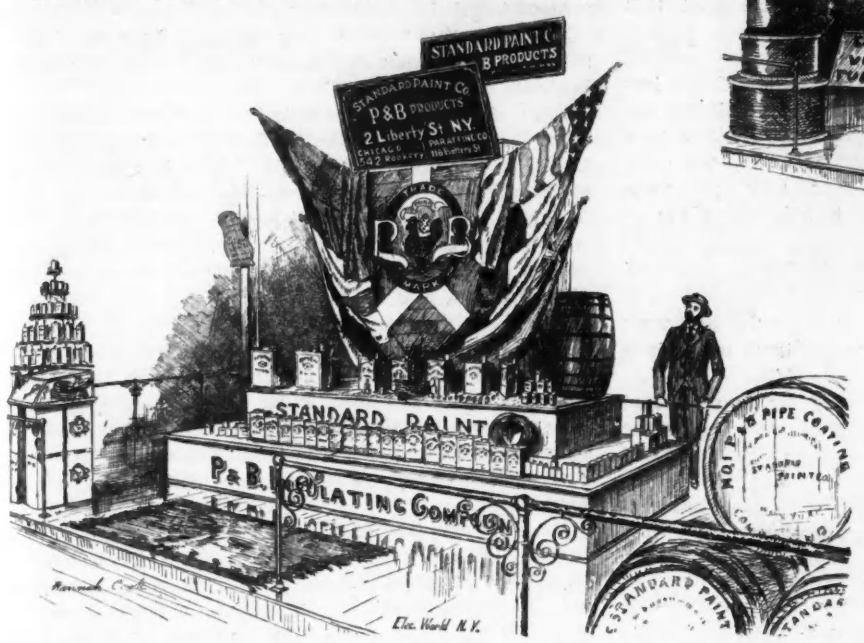
practice in log cabin construction has been closely followed throughout. There is a large doorway in the centre, and a window to one side, and a chimney of fagots represented by Vulca ducts arises a foot above the ridge pole. One only needs the curling smoke of the fire and the back-log to bring him to a full realization of primitive frontier life, and it is unnecessary to say that this little log cabin has attracted more attention, from the general run of visitors at least, than any other one feature of the company's display.

Another pyramid of five spools of Raven Core, White Core and other wires in the extreme northwest corner of the space completes the display of the New York Insulated Wire Company.

We cannot pass on without expressing a regret that such an interesting and complete display as this should have been left to the public for its own interpretation, as has been the case. No literature of any kind is to be had. There is no person in attendance to give information, and the only data obtainable are to be found upon small paper tags, sometimes so illegibly written as to be difficult to decipher, and in some cases even these are wanting.



A CABIN OF VULCA WIRE DUCTS.



A COLLECTION OF INSULATING PAINTS AND VARNISHES.

THE STANDARD PAINT COMPANY.

As before stated, the space of this company completes the square partly occupied by the New York Insulated Wire Company. It lies to the northeast of the latter space and faces the east aisle of the southeast gallery.

In the centre has been erected a white dais, upon a board in the centre of which has been hung a handsome stained glass trade-mark draped in the flags of various nations. Above this is a large sign bearing the words:

THE STANDARD PAINT COMPANY
The P. & B. Products,
2 Liberty street, New York City.
Chicago Office, 542 The Rookery.
Paraffine Paint Company, 116 Battery street, San Francisco.

On either side of the dais is a barrel painted red, upon which are placed cans of armature and field-coil varnish and P. & B. compounds. Upon the dais itself are tastefully arranged cans of various sizes and styles, bearing the labels P. & B. paint, P. & B. cider and vinegar paint, and P. & B. electrical compounds. Pyramids of cans of armature and field-coil varnish and packages of P. & B. waterproof tape are here and there distributed, while resting on the floor and leaning up against the dais are coils of wire whose insulation both of cotton and paper has been saturated with P. & B. compounds, showing some of the applications of this well known substance. In front of the dais, between it and the gateway, the floor is covered with a handsome Turkish rug. Near by is a pyramidal stand in oak filled with cans of the various products of this company. Just south of the entrance is a glass showcase also displaying numerous coils of insulated wire upon which the P. & B. compounds have been used, and to the north of the entrance is another similar case containing samples of wooden conduits and iron pipe, upon which this same material has been used. Waterproof tape is also shown here.

In the northeast corner is a pyramid of three large red barrels branded on the head with:

"The Standard Paint Company, manufacturers of P. & B. paints and compounds, 2 Liberty street."

Within the space allotted to this company are two handsome tables and chairs in oak. On one of the supporting pillars of the roof, which comes up within the lines of this display, is placed this interesting information: "The entire pipe line conveying water from the Waukesha Hygeia Mineral Springs, Waukesha, Wis., to the World's Fair grounds, a distance of 151½ miles, is coated inside and out with No. 1 P. & B. Pipe Coating Compound."

What has been said before of the absence of representatives to give information may be repeated with equal force in regard to this display. Of course, the merits of the products of this company are well known to those who have used them, but there are doubtless many others, who have not been so fortunate, who would like to have information as regards their adaptability to their own needs. These must go away disappointed unless the meagre information contained upon the package labels and that afforded by the few samples of treated objects are sufficient. This further information, however, may be vouchsafed our readers: It is well known that iron gas and water pipes, when buried in the ground, rapidly corrode and disappear, especially in certain soils. The P. & B. pipe coating compound is especially designed to meet such cases, and has met with great success. Wood when placed in like position or in any damp place is also subject to rapid decay, and a preservative against this is found in the P. & B. compound.

But one of the most interesting applications of the P. & B. compound has been to the lead covering of underground cables, especially when creosoted wooden conduits are employed. It has been found that where wooden conduits protected by coal tar products are used the lead casings of the cables drawn into them become rapidly corroded. Many attempts have been made in the way of adding an alloy to the lead, especially of tin, to obviate this difficulty, but without marked success. Chief Walker, of Philadelphia, however, tried the experiment first of painting his lead cables with P. & B. compounds and found the remedy to be a specific. His later recommendations are, to cover the lead with a braiding and saturate this with the P. & B. compound. He believes and has so declared that this entirely protects the lead casing from all corroding agencies to which it is subjected in underground conduits.

THE PHŒNIX GLASS COMPANY.

There is nothing prettier in the private dwelling or in the public hall than handsomely cut and wrought glassware. With the advent of the incandescent lamp decorative art received a new impulse, such as has not been equaled during any similar previous period, and in this new branch of interior decoration the glassblower's art has scarcely been second in importance to that of the electrician. In fact, in the highest development of electric light decorations, the one has been so dependent upon the other as to make both essential. But until within very recent years America produced nothing in the glassblower's art which, strictly speaking, was worthy of being called art at all. Did we desire anything especially nice in this line we must go to the artisans abroad for it. It is, therefore, especially gratifying to American pride to know that American furnaces and annealing ovens and American taste and skill are now producing works of art equal or superior to the

A HANDSOME EXHIBIT OF GLASSWARE.

best produced in the leading art centres of Europe or England. Among the leaders in this great stride has been the Phoenix Glass Company, of New York, Pittsburgh and Chicago, whose display, the centre piece of the Electricity Building, forms the subject of this sketch.

Around the base of what is known as the Edison Tower of Light, with umbrella-like curves, whose ribs are outlined in miniature lamps of all colors, spreads the roof of its beautiful pavilion. The base of the column, whose section is a twelve-sided polygon, forms the support of its roof and also of a series of shelves, upon which are attractively displayed in all of the popular colors and shades the various artistic designs in gas and kerosene lamp globes, shades, etc. Above the shelves, which do not reach quite to the roof, the 12 sides of the prism alternate with mirrors and velour, in which latter are set large cut glass bowls illuminated from behind by incandescent lights. Some of these bowls, 18 inches and 2 feet in diameter, are exceedingly elegant and costly. They show to perfection the highest advances in the glass cutter's art, to which is added the scintillating beauty of the prismatic hues refracted from within.

In the ceiling also are other bowls of cut glassware, illuminated by incandescent bulbs of various colors. Pendent from the ceiling, in almost bewildering profusion, are stalactites and globes of cut glass and etched glass, both plain and in color, and ornamented by tint and Venetian thread work in blue, red and canary. Calla lilies and other flowers, clusters of grapes, pineapples and fruits, are also simulated, and flame-shaped and decorated stalactites in rich cut glass and common, as well as bisque, bobeches and glass candles for gas jets, many of them brilliantly illuminated in different colors, add beauty to the fairy like scene.

The general style of the architecture is Italian Renaissance, and the edge of the dome-like roof is supported by 12 handsome columns in white. There are, in all, from twelve to fifteen hundred pieces of glassware here displayed, some three hundred of which are illuminated from within, and the intermingled rays of ruby and amber and satin white, with the prismatic colors from the rock crystal, leave upon the eye one of the pleasantest effects produced anywhere within the confines of the building.

The display is in charge of Mr. G. H. Fox, who is pleased to give all information in regard to artistic decoration, in which glassware now plays such an indispensible part.

In this connection, the rumor that the Phoenix Glass Company is about to build a new factory somewhere in the gas belt within 200 miles of Chicago becomes interesting.

Incandescent Lamp Proceedings Before Judge Lacombe

On Wednesday, Aug. 2, the cases of the Edison Electric Light Company vs. the Mount Morris Electric Light Company and vs. the United Electric Light and Power Company came up in the United States Circuit Court in this city before Judge Lacombe, on a motion for a preliminary injunction restraining the defendants from using infringing lamps and asking for an accounting of profits.

Mr. Clarke, counsel for the Mount Morris company, asked to have the case stand over until October, on account of the absence of one of their counsel, Mr. Elihu Root.

The Court, interrupting the counsel in his argument for adjournment, asked: "Is the defendant a manufacturer or a seller?"

Mr. Clarke: "This defendant uses incandescent lamps in connection with a plant which was installed before"—

The Court (interrupting): "This is the same patent which the court has already had before it, and how can I give you a long adjournment (unless you are disputing the infringement) without a stay, and on an application at the foot of the case which has been heard at this circuit, and before the Court of Appeals, and then before the Court of Appeals again—twice?" (Interrupting counsel): "Is there any dispute that there is an infringement of the patent? Is it a different kind of apparatus from that we had before us in the other case?"

Mr. Clark stated that the plaintiff has gone on since the decision furnishing the lamps used in connection with that plant, but now that they refuse arbitrarily—

The Court (interrupting): "They have a right to under the patent. That is what the monopoly given them under the patent is for. A man may sell his lamps or stop selling them, just as he pleases." The court then announced that it would grant a short adjournment, but that an adjournment until October would have to be upon a stay in the meantime.

Mr. Cravath, counsel for the United Electric Light and Power Company, then spoke for that company. He stated that one of the two companies in these suits was started in 1880 and the other in 1886. They have invested upward of five millions of dollars in the business, not of manufacturing lamps or of selling them, but in furnishing illumination. They have no connection in the fight between the parent companies, but have been simply pursuing their business of furnishing light and power and have the necessary lamps for that purpose. They felt that a clause which was inserted in the order of the Circuit Court of Appeals amounted to an expression of feeling on the part of that court (a feeling, at all events, if not a decision) that there were equities in favor of these users, who had invested millions of dollars in the business, which would have to be ajudicated upon finally, and which differed somewhat from the equities in favor of manufacturers who had taken the chances of a manufacturing business in violation of these Edison patents, and these were the first suits to bring up these questions.

Mr. Cravath dwelt upon the fact that the present is not in any sense a branch of the litigation between the parent companies.

The Court: "Upon the statement of your associate, this very company had noticed, by the beginning of suit against it over two years ago (even longer ago than that), that it was claimed that they infringed this patent."

Mr. Cravath: "That is true."

The Court: "And yet in the face of that notice it has gone right on extending its business, on the theory apparently that if an infringer would only infringe to a large extent he would secure immunity. They were not suddenly shut down, but had practically two years opportunity to find some other lamp to take the place of the infringing one."

Mr. Cravath: "We have not known what the policy was to be."

The Court: "But you have known what the law was; and you have known what this patent was ever since Judge Wallace's decision."

Mr. Cravath stated that the order of the Circuit Court of Appeals gave leave to the defendants to apply for a modification or vacation of the injunction upon proof of refusal to supply lamps, except upon terms which would be considered unfair in specific cases. That provision certainly gave notice to consumers that they would have their day in court, provided they were not fairly treated by the sellers of these lamps; the Edison Illuminating Company had been furnishing these concerns with lamps; it is true that they have said from time to time that they did not intend to waive their rights by filling orders for lamps, and in more than one case representatives have been met with the statement on the part of the Edison Illuminating Company or their agents that, "We have not yet determined what our policy will be with reference to the sale of lamps, but in the meantime will fill your orders. In time we will determine what our policy will be."

The Court: "If they had refused instanter on the decision of the Circuit Court of Appeals to furnish more lamps, every user might have thought he had some cause for complaint; on the other hand, for a few months they go on and furnish lamps, so as to give opportunity for everybody to adjust themselves to the new conditions. Now those same customers say: 'You have misled us; it is inequitable.'"

Mr. Cravath stated that he had not said they were misled, but simply that they did not know what the policy of the complainants was to be. All that he asked was ample time to bring out the important questions affecting an investment of five million dollars, and they would be sorry not to have Mr. Root in this case.

The Court: "There have been a great many counsel in the case from first to last."

Mr. Cravath: "I have tried to explain that this is not a litigation of the Westinghouse company."

The Court: "But there are certain questions, no matter who the litigants may be. In the first place, the validity and scope of the patent have already been passed upon; secondly, whether or not this is an infringement (and presumably there is no dispute about it); and, in the third place, these various equitable considerations of which you speak peculiar to each individual defendant."

Mr. Cravath said that if the order of the Circuit Court of Appeals meant anything, it meant that there might be certain equities in favor of the users of electric lamps which did not exist in favor of the manufacturer; and the court recognized that the questions might in time come before the court. These questions are now about to come before the court, and they are not the same questions which it has already considered; they are new questions, but heretofore recognized.

The Court (interrupting): "But you are making no statement which would show that this particular case comes within the proviso of this order."

Mr. Cravath said that both companies were established prior to the order; that their installations were almost all prior to it, and that there had been very little extension of the business since that time.

The Court: "Whether there has been or not—but assuming that there has not—what of all that?"

Mr. Cravath: "I say that all that brings up very important questions under the decision of the Court of Appeals."

The Court: "It is unfortunate that the Court of Appeals decision incorporated that clause, for it appears to have misled counsel very much; I am very sorry it is there, because we intended by it to meet one particular suggested phase of the case which existed at that time. It was put in from abundant caution, but seems to have been taken as a sort of broadcast proviso that almost anybody can come in and say 'we want to have lamps.' It was stated on the argument (although it had been repudiated by counsel for complainant in that case) that the Edison company proposed to hold this lamp as a whip over everybody in the United States of America; that they would not give them that lamp unless they would buy all their dynamos and everything else from them; and that by holding this whip over them they could drive them into camp and break up and bankrupt everybody engaged in electric lighting all over the country. If that state of affairs was presented it might be that the court would see some way to say that, in spite of the order it had made, it was not fair that they should do it."

Mr. Cravath: "That is the very situation we want to bring up before the court in this case. They propose to destroy an investment of over five millions of dollars."

The Court: "What have they done to destroy it? They refused to sell lamps; that is all."

Mr. Cravath: "These very papers show that they refuse to sell lamps; they desire to get a monopoly of the business for themselves."

The Court: "The question is not what they desire, but what they have done. So far they have simply refused to sell you lamps. That is all. There has been no negotiations between you and them; they have not come to you and said, 'We will sell you these lamps if you will cut off all connection with the Westinghouse company, and hereafter buy all your electrical equipment and supplies from us, and rip out all of your plant and put in ours.'"

Mr. Lewis, counsel for the complainant, stated that they had not refused to sell lamps up to the present time, and that they were suing them for using Sawyer-Man lamps; he also stated that the defendants, although users, come more nearly in the class of manufacturers, as not being incidental users, but users as a business.

Mr. Cravath said that out of the five million dollars invested possibly only $150,000 was in lamps, and a great deal could be said in favor of the proposition that an investment of $4,850,000 should not be ruined because of the claim as to $150,000 worth of lamps used. All that he asked was to be given ample time, and they would be glad to have enough time so that Mr. Root, on account of his familiarity with the litigation, might be associated with them.

Mr. Clarke offered, on the part of the Mount Morris company, to give bonds to secure delay.

The Court: "Nobody can fix the penalty of that bond. There is no way in which the damages under that bond are susceptible of liquidation; or I know of none."

Mr. Clarke called the attention of the court to the fact that Mr. Lewis gave no reason why the motion should be made at the present time, in the middle of the summer.

The Court: "You might assume that he would make this motion, as he had all the others; for the time of the patent is running away; and that they would be under injunction at some time or other. I have decided what I shall do; I shall give you an adjournment until the session after the next one—a peremptory adjournment; and at that time you must find some counsel prepared to argue it."

Mr. Clarke: "At what time will that be?"

The Court: "I cannot say exactly; the next motion day will be on the 15th; probably two weeks after that."

The order referred to above, which is signed by Judge Lacombe, is as follows: "Ordered, that the defendant be enjoined, pendente lite, from infringing the second claim of the patent in suit, Letters Patent No. 223,898, granted to Thomas A. Edison, Jan. 27, 1880, with leave to the defendants to move hereafter for the vacation, suspension or modification of the said injunction, upon proof of specific instances of refusal on the part of the complainants, or either of them, to supply the lamps of the patent upon terms reasonable under the circumstances of the particular case, to the owners of electric lighting apparatus which was installed or purchased before the rendition of the interlocutory decree of the Circuit Court sustaining the validity of the patent, for use with such apparatus." The decree referred to is that of Judge Wallace, dated July 23, 1891, sustaining the Edison patent.

Edison Lamps in the Imperial Hotel.

In our last issue we referred to a report that the Imperial Hotel, which was enjoined against using infringing lamps, had come to terms with the Edison Illuminating Company, who would furnish lamps in consideration of the proprietor of the hotel signing a contract to purchase lamps for a term of years from that company. This report, we learn, is incorrect; no lamps have been purchased from the Edison Illuminating Company, and their agent refused to sell any to the proprietor of the hotel. Part of the hotel lighting plant is of the Edison system, and all of the dynamos, including those of another system, now connect to common bus bars, so that the "Edison current" under this arrangement goes to every part of the building, instead of being confined to a small section as before, and Edison lamps for the entire building have been purchased from another source than the Edison Illuminating Company.

Practical Aspects of Low Frequency Electrical Resonance.—III.

BY M. I. PUPIN.

5. *Resonance in Circuits with an Impressed Complex Harmonic Electromotive Force.*—If the impressed E. M. F. is a complex harmonic, then the circuit may be brought into resonance with any of the component harmonics. I have an apparatus here which is capable of producing E. M. Fs. of almost any complexity. I call it an electrodynamic current interrupter, for want of a better name. It consists of a phosphor bronze wire, the vibrator, a, b, e (Fig. 6), stretched between the poles of a Weston horseshoe magnet d. A short, thin, amalgamated copper wire b, the dipper, is soldered on the vibrator. The vibrator is stretched like the wire of a monochord, over two hard rubber bridges a e, and its tension can be varied by a screw and lever, f. The dipper, c, whenever it dips into the mercury cup closes an electrical circuit, F f e b c g A, and the vibrator is then repelled upward by the force of repulsion between the magnet and the current flowing through the vibrator. One gravity cell, f, is sufficient to work this apparatus. It is evident that the fundamental period of the interrupted current will be equal to the period of the vibrator. To change this period, say, to make it equal to the period of this tuning fork, which is 256 complete vibrations per second, I simply strike the tuning fork, hold it then near my ear, and by turning the screw, f, of the stretching lever, I vary the tension of the vibrator until the rate of the vibrator, and that of the tuning fork, are in perfect unison, which can be easily recognized by watching the beats. This whole process of tuning takes up, as you see, only a few seconds. In series with the cell f, and the vibrator, we have a small coil, A, containing a well packed bundle of very thin iron wire, and in shunt with a is a condenser d. This condenser performs the function of bringing this primary circuit into partial resonance with the vibrator, which is recognized by the circumstance that at the moment of resonance the spark at the dipper is a minimum.

A simple reflection will show you that the current generated by this interrupter is a complex harmonic. To analyze it into its component harmonics I shall adopt the method employed in acoustics.

A complex sound is analyzed by the well-known resonators of Helmholtz. These resonators are constructed in such a way that they will respond to one vibration only, and, also, in a measure, to its upper harmonics. To any other vibration they are practically mute. By a number of such resonators we can find out, in the manner first pointed out by Helmholtz, all the vibrations which are contained in a complex sound.

The secondary circuit, b c t e, given in the diagram of Fig. 6, performs the functions of such a resonator; it is, in fact, an adjustable electrical resonator; c is a small auxiliary coil, which you see here; e is a Marshall condenser, and t is a telephone, whose note tells me to which of the component harmonics the electrical resonator responds. The telephone is silent now, at any rate, as far as you can tell, because the condenser plugs are all out. Now, with this plug, I insert a small capacity. The note which you hear is evidently much higher than even the octave of the vibrator. The electrical flow in the resonating circuit is approximately the same as if we had in it a simple harmonic E. M. F. of the same frequency as this note. I insert another plug, so as to increase the capacity. The note which you now hear is deeper. The difference between the two notes is rendered very striking by making and breaking the contact of the second plug in rapid successions, as I do now. The sound of the two notes, succeeding each other at regular intervals, resembles very much the sound of bagpipes. I insert another plug, so as to increase the capacity still more. The note which you now hear is still deeper. It is the note of the fundamental electrical vibration, which is the same as the vibration of the vibrator. I know that, because, as I continue inserting more and more plugs, you do not perceive any further change in the sound. The capacities which I introduced by the three plugs are to each other very nearly in the ratio of 1 : 9 : 25, hence the frequencies of the three harmonics contained in the impressed E. M. F., and which I have detected by the resonating secondary

The impressed E. M. F. can therefore be written

$$E = E_1 \sin pt + E_3 \sin 3\,pt + E_5 \sin 5\,pt.$$

Still higher harmonics are present, but they are too weak to be heard all over this room.

I shall, presently, discuss a method by means of which we not only detect the presence of these harmonics, as I have just done, by means of this telephone, but also determine the relative strength of each. The method imitates, in a certain measure, Prof. Langley's bolometric method of determining the distribution of energy in the spectrum of a given complex luminous vibration.

Before making the next step in my discourse I wish to call your attention to an application of resonant circuits (in connection with the electrodynamic interrupter) to a method of producing simple harmonic currents of constant and easily determined frequency.*

I simply tune the vibrator by means of a standard tuning fork, and then weed out the upper harmonics by successive transformations. In this connection I ought to mention that Prof. Duncan, of Johns Hopkins University, informed me several weeks ago that he was also weeding out harmonics. I now remember that I got the expression "weeding out" from him, but I have used it in my papers on "Low Frequency Resonance" without giving him credit for this beautifully selected expression.

6. *On the Resonant Rise of Potential.*—The question arises now, how are we to tell experimentally whether a circuit is in resonance to an impressed E. M. F. or not? Several methods suggested themselves to my mind in the course of my work. I selected the one which appeared to me to be the most sensitive and most interesting. It also suggests a new way of transforming electrical energy, which some day may, perhaps, be of some practical importance. I wish to discuss this method now, but only very briefly.

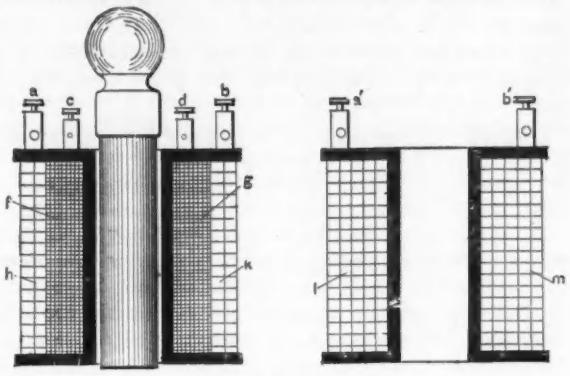


FIG. 8.

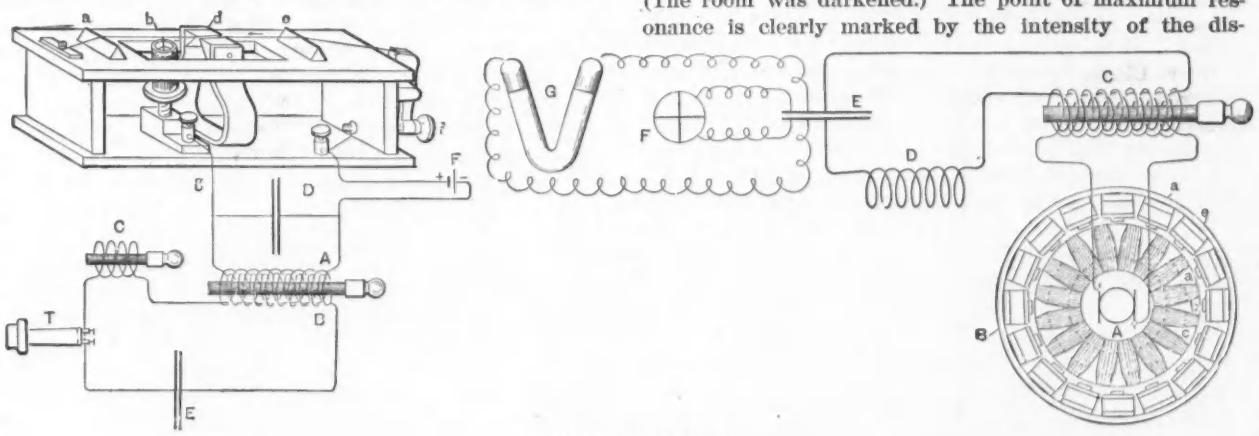
As I observed before in the discussion of the motion of the torsional pendulum, represented in Fig. 5, when the moving force and the pendulum are in resonance, then both the amplitude of oscillation and the amplitude of the velocity reach their maximum value. And so it is also with a circuit possessing self-induction and capacity. By varying gradually the one or the other the current (which corresponds to the velocity of the pendulum) will continually increase. But the difference of potential in the condenser (which corresponds to the elastic reaction of the suspension wire) will also increases continually. When the point of resonance has been reached, then evidently both the current and the difference of potential in the condenser have reached their maximum values. This maximum difference of potential in the condenser can be many times greater than the impressed E. M. F., because just as in the case of the torsional pendulum the elastic reaction of the suspension wire is an accumulative effect of the moving force, so in the electrical circuit the potential difference in the condenser is an accumulative effect of the impressed E. M. F. Now, since a resonant electrical flow, which we have just considered, consists simply of a transformation of electrokinetic into electrostatic energy, and vice versa, during each half period accompanied by a frictional loss due to ohmic resistance, it is evident that the amplitudes of these two kinds of energies must be equal to each other, that is, we shall have in the usual notation

$$\tfrac{1}{2} P^2 C = \tfrac{1}{2} L \frac{E^2}{R^2}.$$

But since owing to resonance we have $p^2 L C = 1$, the preceding relation reduces to

$$P^2 = p^2 L^2 \frac{E^2}{R^2} \text{ or } P = p L \frac{E}{R}.*$$

It is evident, therefore, that with little more than ordinary frequency, say 350 periods per second, and an inertia coil of considerable self-induction and small resistance, high potentials can be obtained in the condenser by bringing the circuit in resonance with the impressed E. M. F. Connecting, therefore, the condenser to a voltmeter we can tell very accurately when in the course of our tuning of the circuit we have reached the point of resonance, because, as I shall presently show you, the voltage goes up very rapidly when the condenser capacity or the self-induction are near the point of resonance. It is this electrometric method which I have employed in my investigations on "Low Frequency Resonance." †



FIGS. 6 AND 7.

The same method can be, and has been, employed by several investigators in the study of Herzian oscillations.

To show you how strong this resonant rise of potential can be, I have within the last few days wound these two inertia coils (see coil a' b' in Fig. 8) and borrowed this most excellent mica condenser from our well known electrician, Mr. Wm. Marshall, for which kindness I feel very grateful to him. The impressed E. M. F. is obtained in the following way: A small 16-pole alternator running at about 2,800 revolutions per minute and generating an E. M. F. of about 600 volts feeds the primary of this small transformer (c d, Fig. 8). Diagram (Fig. 7) gives the form of armature A and field B of the machine. Coils a, b, c, d, e show how the machine is wound. The transformer consists of a hard rubber spool wound with about 3,000 turns (Fig. 8) of No. 20 A. W. G. wire for the primary. The secondary h k consists of about 500 turns of No. 16 wire. A well-packed bundle, e, of very fine iron wire is the iron core. This transformer is indicated by C in Fig. 7. In series with the secondary we have inertia coils D, and the above mentioned mica condenser E of 0.2 mf. capacity. The inertia coils consist of hard rubber spools like a', b' (Fig. 8), wound with No. 14 wire. The total self-induction of the secondary circuit is about one henry, without iron in the inertia coils. The poles of the condenser E are connected to a Sir William Thomson electrostatic voltmeter F and also to a vacuum tube G, with condenser electrodes, that is to say, tinfoil coatings on the outside of the tube (indicated by the shaded part in the diagram). I now start the machine, and by weakening the field of the driving motor I gradually increase the speed of the machine. As you see the voltmeter needle is steadily advancing with the speed. To get the greatest deflection of the needle I ought to have about 350 periods per second. Now I shall advance to very near this speed. The voltmeter indicates now 2,000 volts. The impressed E. M. F. in this secondary resonating circuit is only about 100 volts. Instead of increasing the speed so as to reach the point of perfect resonance I prefer to leave the speed constant, and by gradually inserting these five iron wires to increase the coefficient of self-induction until that value is reached, which, with the given speed and capacity, brings the circuit in resonance with the impressed E. M. F. I am doing this now and watching the voltmeter needle at the same time. Now the voltmeter indicates 3,000 volts, which is 30 times the value of the original E. M. F. This is the point of resonance, because if I push the iron wire lower, the needle goes back. The point of resonance is very sharply defined, because the slightest motion of the iron wire, one way or the other, makes quite a considerable difference in the reading of the voltmeter. The point of resonance can be shown to a large audience like this much more easily by connecting the poles of the condenser to the tinfoil electrodes of the vacuum tube G. A discharge starts in this tube at about 2,000 volts. Now, as I insert these iron wires into the inertia coil you see the intensity of the discharge increases. (The room was darkened.) The point of maximum resonance is clearly marked by the intensity of the discharge, as you see. Now I insert the iron wire too far; as you see the discharge is stopped. I can start it again by raising the iron and stop it again by taking the iron wire entirely out, as you see.

* Pupin, "Electrical Oscillations of Low Frequency and their Resonance," *American Journal of Science*, April, 1893.

* This relation was first obtained, I believe, by Prof. Oliver Lodge. (See a letter by Prof. O. Lodge, London *Electrician*, April 24, 1891.)

† *American Journal of Science*, April, May and June, 1893.

The Association of Edison Illuminating Companies.

Mr. W. J. Jenks, secretary of the Association of Edison Illuminating Companies, issued a supplementary notice calling attention to some of the special features of the convention, beginning in Chicago Tuesday, Aug. 8. The General company had signified its intention of being represented by several of its officers, who took this opportunity of discussing with the members of the association such questions as are of general interest. The programme included the following reports and papers: (1) Report of Committee on Lightning Protection; (2) Report of Committee on Grounding the Neutral Wire; (3) The Heating of Siemens Cables in Air, Water and Soil, by A. E. Kennelly; (4) Central Station Switchboard Work, by A. B. Herrick; (5) Test of Apparatus at the Brooklyn Company's Williamsburg station, by W. S. Barstow.

A letter had been received from Mr. Ralph W. Pope on behalf of the American Institute of Electrical Engineers, extending the privileges of the headquarters of that association in the Electricity Building to the members of the Association of Edison Illuminating Companies.

THE ELECTRICAL WORLD'S DIGEST

OF

CURRENT TECHNICAL ELECTRICAL LITERATURE.

(Compiled from the principal foreign electrical journals.)

BY CARL HERING.

ELECTRO-PHYSICS.

Duration of the Discharges of Induction Coils.—Dr. Jones, in the Lond. "Elec.," July 21, gives the results of some tests which show that the secondary discharges are not as brief as is generally supposed; with a coil 7 in. long and 2¾ in. in diameter and with 52 to 55 breaks per second, the duration of the break discharge was 0.0134 second, and for the make 0.0046 second; the record was made on strips of blotting paper wetted with starch and iodine of potassium and secured to a revolving drum; the records are reproduced in the article; he finds that the intervals corresponding to periods of no current are quite short; he estimates them at about 0.001 second, or less in a total period of 0.019 second; a vacuum tube seems to shorten the duration of the discharge considerably.

High Pressure Experiments.—Referring to the experiments described in these columns last week, Mr. Swinton writes to the Lond. "Elec. Rev.." July 21, that the bubbling or boiling takes place only with oil, alcohol or other similar fluids, while with water the surface is not disturbed, but an octopus discharge of bright sparks takes place over the surface of the water, leaving the wire where the latter intersects the surface.

Circular Ferro-Magnet Polarization.—The Lond. "Elec. Rev.," July 21, contains a note regarding the recent investigation of Mr. Hirsch.

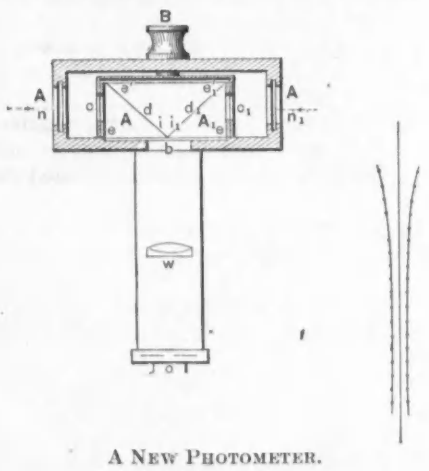
MAGNETISM.

Theory of the Electromagnet.—The "Elek. Zeit.," June 30, July 7 and July 14, contains a somewhat extended article by Dr. Froelich. He discusses the works of Hopkinson, Kapp and Kennelly, and from them deduces formulæ regarding electromagnets. The article is, to a great extent, of a mathematical nature, but the formulæ are based on empirical data. In a number of cases he compares the calculated with the observed results, showing very good agreement; the article does not admit of being abstracted here, but is recommended to those who are specially interested in this subject. A short abstract of it will be found in the Lond. "Elec.," July 21.

Rotary Magnetic Fields.—Mr. Lucas, in "L'Elec.," July 22, gives a theoretical discussion of rotating magnetic fields, and polyphase alternating currents.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Photometer.—The "Elek. Zeit.," July 14, reprints a paper by Mr. Lehmann, in which he describes a photometer, based on the Joly principle, and some tests made with the same. The photometer is shown in the adjoining cut, in



A New Photometer.

which A, A_1 are two total reflecting prisms whose surfaces at c, c_1 are ground so as to destroy their transparency; W is a lens for obtaining sharp, well-defined views of these two surfaces; B is a milled head, by means of which the case containing the prisms can be revolved through 180 degrees in order to eliminate the errors in the instrument; the rest of the instrument explains itself. In order not to have to stop to take the reading, whereby the eye is rendered less sensitive for the adjustment, an ingenious device is added in the form of a pencil point secured to the movable portion and so arranged over a piece of paper, which can be moved at right angles to the bench, that instead of taking a reading the pencil point is merely depressed, making a dot on the paper; the prisms are then reversed and another reading taken, and after thus taking successive readings with alternate positions of the prisms and successive positions of the paper the series of points will be about as shown in the figure, the upper series representing the first reading, showing that the readings approach each other and reduce the error to a minimum. He appears to prefer keeping a constant distance between the screens and one light, varying only the distance to the other. Very extended experiments were made with incandescent lamps in order to determine the best distances to be used; that is, those for which the errors are least; a table of data and a set of curves are given, showing that the error diminishes as the distances become greater; this applies to both the maximum and the mean errors; when the distances become small the errors increase very rapidly; for an electrical lamp of about 8 c. p. and a standard of 1 c. p. the best results were obtained for a distance of 1.3 metres for the latter (it appears that the variable distance was that to the standard lamp, but this seems unlikely, as it would make the other distances quite great); in taking 40 readings the mean error was 0.3 per cent. and the maximum not more than 0.56 per cent.; for the conditions occurring in ordinary practice he thinks that an error of less than one per cent. can be arrived at. He then varied the candle light, the results of which are given in tables and curves, which show that the error is small for low candle powers, that it increases rapidly and becomes a maximum at 2 c. p., after which it decreases rapidly, arriving at a minimum at about 8 c. p.; this refers to the comparison between two equal lamps; when, however, only one was varied up to a difference of 1 to 13 the mean error was not greater than 1.7 per cent. He concludes that such a photometer, besides being simple and cheap (the cost of this one was $20), is sufficiently accurate for most purposes.

Arc Standard.—In an editorial discussion of recent papers on this subject the Lond. "Elec. Rev.," July 21, among other things states that Dr. Thompson has shown that it is easy to insure the illumination of the apparent aperture by employing a magnet to deflect the arc to the front face of the carbon. It is also claimed to be an advantage to use as a standard a light which is greater than that to be measured, as any error in reading the scale will then be a small fraction of the quantity to be measured.

Measuring Alternating Magnetic Fields.—Referring to the method of measuring magnetic fields, mentioned in these columns last week, the Lond. "Elec.," July 21, states that Mr. Mordey in 1891 showed that a very good magnetic leakage detector for transformers may be made of a spirit thermometer and a mercury thermometer side by side, the leakage setting up eddy currents in the mercury and not in the spirit. If the fields are very weak Dr. d'Arsonval uses a petroleum or an air thermometer, in the bulb of which is placed a little copper tube.

Measurement of Resistances with Alternating Currents.—The "Elek. Zeit.," June 23, reprints an abstract of an article by Prof. F. Kohlrausch ("Wied. Ann.," Vol. 49, No. 6), in which he describes the various errors which arise and the way in which they are avoided.

A New Form of Induction Balance.—The "Elek. Zeit.," June 23, gives an abstract of an article by Mr. Wien (from "Wied. Ann.," Vol. 49, No. 6), in which he describes a modification of the Wheatstone bridge for measuring induction; the abstract is not as clear as might be desirable.

DYNAMOS AND MOTORS.

Heating of Armatures.—In the "Elek. Zeit.," June 30, Mr. Schulz gives the results in detail, together with the dimensions of the machines, of a series of carefully made tests to investigate the heating of armatures. The article itself is recommended to dynamo constructors. One of the objects of the test was to eliminate the heating of the iron from that due to the current in the windings; in one case he finds that when not in motion the temperature rose 17 degrees C., due to the current in the windings only, in which case there was, of course, no ventilation; when revolving the temperature rose only 4 degrees C. higher for both the effects of the current and the magnetization, than when there was no current flowing; this, he claims, shows the importance of the heating due to the magnetization; the increase in temperature was 33 degrees when no current was flowing, and 37 degrees when current was flowing; the heating of the iron is, therefore, by far the most important of the two (this, however, depends on the proportions of the copper and the iron, for it is evident that if the copper windings have too small a cross-section the heating due to the current may become very great). In conclusion he deduces the following formula from these experiments: $T = a\ P\ n\ C\ c + S$, in which T is the increase in temperature due to the magnetism, a the degree of saturation that is the ratio of the actual density of the lines of force to the number 18 000, P the number of poles of the machine, n the number of revolutions per minute, C the volume (presumably in cubic centimetres), S the surface (presumably in square centimetres), c a constant depending on the ventilation of the armature and on the quality of the iron (presumably also on the thickness of the plates, a factor which does not appear to enter elsewhere in this formula); experiments showed that this formula gave results sufficiently close for all practical purposes; it should be noticed, however, that the constant c may vary considerably in different machines; the experiments were made with a drum armature and not with a ring armature, and the formula therefore applied only to the former.

Compensator.—The Sayers compensator for feeders, mentioned last week, is illustrated in the London journals, July 21; a very good illustration, showing an external view, will be found in the Lond. "Elec. Rev.," and also in "Ind. and Iron," July 21, the latter being the better.

TRANSFORMERS.

Transformation of Continuous Into Alternating Currents.—Mr. Lucas, in "L'Elec.," July 8, describes at some length and with the aid of a number of illustrations an apparatus devised by himself for this purpose; in principle it consists essentially of two revolving cylinders, for instance like two dynamo commutators, the insulation between the bars of which have about the same width as the bars themselves; all the bars are connected to a common slide ring; they are both keyed to the same shaft, but displaced slightly with respect to each other; the continuous current is let in through the slide rings, and the alternating current is obtained from brushes resting on the commutator bars, there being a pair of such brushes at the top and a pair at the bottom; the positive current, for instance, will find an outlet either through the top or the bottom brush, while the negative current will pass out of the brush on the opposite side (in principle, therefore, this does not seem to differ materially from the usual commutator for re-dressing alternating currents; it appears, furthermore, that, as in other forms of such apparatus, the source is either periodically short-circuited or the circuit periodically opened by the commutator, unless the brushes are set with mathematical precision, which of course is impossible); by doubling or trebling the number of sets of brushes, and placing them at proper angles with each other, diphase and triphase currents may be generated. Working illustrations of the complete apparatus are given, but it seems to be still in the laboratory stage; little is said of the sparking except that it is not very great for about five ampères; one of the objects appears to be to apply it to currents of very great frequency, as, for instance, 20,000 alternations per second.

Transformer Design.—In his serial in the Lond. "Elec. Eng.," July 21, Mr. Weekes describes the principle and the construction of the hedgehog transformer, accompanying his description with some data and a working drawing.

Designing Small Transformers for Arc Lamps.—Mr. Carter, in his serial in the Lond. "Elec. Rev.," July 21, gives briefly some practical formulæ and rules for designing such transformers.

ARC AND INCANDESCENT LIGHTS.

Arc Lamp.—"L'Elec.," July 22, illustrates and describes an arc lamp in which the two carbons situated at the bottom of the lamp are inclined to each other, resembling the letter V, with the arc at the lower apex. In the earlier experiments it was necessary to use carbons of a semi-cylindrical cross-section in order to keep the arc on the lower side. The later construction of the lamp is exceedingly simple; the carbons are suspended by two bent levers, pivoted at the top of the lamp, the upper ends of which are moved by a core which is drawn into an electromagnet; the lamp is quite short and can, therefore, be used to advantage under low ceilings; by an adjustable spring the lamp may be regulated to take from 4 to 10 ampères; to keep the arc on the lower sides of the carbons the upper halves of the carbons are made harder, the best results having been obtained by nickeling them (why not use a magnet just above the arc to keep the crater on the lower sides?).

Arc Lamp.—"Elek. Zeit.," June 30, gives a short description and illustration of the new lamp of Messrs. Hartmann & Braun, one of the features of which is that the whole lamp is but little higher than the globe itself.

Arc Lights.—Mr. Guy, in his serial in the Lond. "Elec. Eng.," July 21, discusses the hanging, trimming and running in parallel of arc lamps.

Incandescent Lamp Manufacture.—The serial by Mr. Ram is continued in the Lond. "Elec.," July 21; he describes several other ways of making fibres, the method of carbonizing and the furnace used. The article is of an eminently practical character and contains many very practical hints.

ELECTRIC RAILWAYS.

Electric Railways in Europe.—"L'Ind. Elec.," July 10, gives some statistical data which is the best that has, to our knowledge, been published about European electric railways. From this we have compiled the following table in which some of the data is more easily summarized and compared; unfortunately the statistics in the original are quite incomplete and therefore the data in the accompanying table are not quite complete, but it is doubtless sufficiently so to give a very good general idea.

Country.	Number of roads.	Miles of road.	Thomson-Houston and Sprague.	Siemens & Halske.	Miscellaneous.	Overhead trolley.	Accumulator.	Conduit and central rail	Underground.
Germany	16	98.1	79.5	18.6		91.5	....	....	5.6
England	16	49.5	5.6	11.4	32.5	15.8	8.1	21.2	3.2
France	12	54.7	35.0	0	19.7	43.3	11.4	....	....
Austria	3	39.3	0	36.2	3.1	2.66	....	33.5	....
Switzerland	8	17.1	5.4	0	11.7	17.0	....		....
Italy	4	12.3	10.4	0	1.9	10.4	....	....	....
Russia	2	9.0	4.7	....	4.3	4.7	....	....	....
Spain	1	8.7	8.7	....	....	8.7	....	....	....
Sweden	1	4.7	4.7	....	....	4.7	....	....	....
Belgium	2	3.4	3.4	....	....	3.4	....	....	....
Holland	1	....	....	....	....	....	....	....	....
Totals	66	296.8	157.4	66.2	73.2	202.1	19.5	54.7	8.8

The table includes the roads in construction as well as those about to be constructed. In order to show what a large proportion of the total mileage is of American origin we have compiled the mileage under the headings shown; that under Miscellaneous is built by European companies; with the exception of the roads in Austria and England, the American companies have built by far the greater proportion, the T. H. and Sprague companies having constructed over half of the total of about 300 miles; of the 66 roads those companies have constructed 31, the S. & H. Co. 10, while the remaining 25 include different systems, chiefly English and Swiss, among them being three roads

constructed by Hopkinson and three by Thury; an interesting feature is that the newer roads are almost exclusively of the Thomson-Houston system. We have also divided the mileage of the roads among the four different systems showing how very much the overhead trolley system predominates, the principal exceptions being the conduit road in Budapest, the accumulator roads in France and England, and the central-rail roads in England; it will be noticed that in over two-thirds of the total mileage the overhead trolley system is used.

Accumulator Traction.—Dr. Buettner, in the "Elek. Zeit.," June 23, discusses the subject of accumulator traction. Among other things he comes to the following conclusion: That a system in which the batteries and motor are on the car itself is in general better than when they are both on a separate locomotive, or when the battery alone is on a separate tender; the latter two systems may be better when the roadbed is not strong enough or when the cars are not large enough; the first cost, however, will thereby be increased (he does not, however, compare this first cost with that of relaying a heavier roadbed); regarding the voltage, he says the economy of space is better if fewer cells of larger capacity are used, especially when lead-lined wooden cells are used; he believes from 110 to 150 volts—that is, a battery of from 60 to 80 cells—is the best; he does not recommend the departure made in England, in which only 40 cells were used; the failures in many cases, he thinks, are due to the fact that traction cells are made with too thin and frail plates and with too small a distance between them; he believes in making them strong and solid and a space between the plates of not less than $\frac{1}{4}$ of an inch; special attention should be given to the efficiency of the motor, which in accumulator traction is of much greater importance than in the trolley system; the motors should be series wound; the batteries should never be discharged at a greater rate than in three hours; for starting and mounting grades the batteries should be coupled in two series groups in parallel or in four series groups in parallel; the most important point in not to discharge the batteries too low, and he recommends using $\frac{2}{3}$ to $\frac{4}{5}$ of their capacity, but not to go as low as $\frac{1}{2}$, as their efficiency will thereby become low; he believes that charging up to 2.6 volts per cell is necessary to prevent sulphating and buckling.

Telephone and Electric Traction.—The English journals of July 21 publish the conclusions of the Electric Powers Committee regarding the interference between railway and telephone grounded circuits. The conclusions are, briefly, that electric railways may use earth return leads, but that they must take reasonable care not to corrode gas or water pipes; the use of earth returns are to be regulated by the Board of Trade, who have the power to suspend the operations of railway companies if they are not conducting themselves and their earth returns properly; they are to follow the Board of Trade regulations in keeping the resistance of the earth return as low as possible, so as not to disturb telephones and telegraphs; after two years telegraph and telephone companies cannot make complaints about railway circuits unless their own circuits have insulated returns; the Board of Trade is to be the arbitrator in case of any difference. The committee also recommends that telephone companies should be given facilities for laying their wires underground, and that the railway companies should use such low resistance earth returns that no injurious leakage can occur.

CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

Parsons Steam Turbine Tests.—The Lond. "Elec.," July 21, publishes an abstract of a report by Prof. Kennedy

CURVE OF STEAM TURBINE TESTS.

on tests made with an improved form of this turbine. The machine tested was in external dimensions almost exactly the same as that tested by Prof. Ewing (see The Electrical World, Dec. 10, 1892, p. 375, and Dec 17, p. 399), differing only in a re-arrangement of the plates and discs, by which its output has been very considerably increased. It had six high pressure single discs and one low-pressure double disc, the two sides of which are in parallel. It ran 4,500 revolutions per minute. For all but light loads there was very considerable superheating. There were a number of unavoidable leaks in the steam pipes, for which no allowance could be made in the results. The above cut gives the results of the tests, which in the article is accompanied by a table giving the data more fully. Experiment E is the most important. The duration of the run was over two hours. At this trial the output was at the rate of 110.8 kilowatts, or 148.5 e. h. p.; the boiler pressure was 94.5 pounds, and the amount of superheating was 66.7 degrees F., the average vacuum being 13.95 pounds; the water consumption was 27.9 pounds per kilowatt hour, or 20.8 pounds per e. h. p. hour (although the external dimensions of this machine were the same as of that tested by Prof. Ewing the maximum output which could be maintained continuously was 50 per cent. greater, and the steam consumed was reduced from 27.6 to 20.3 at full load, an improvement of nearly 24 per cent.). The best test of the accuracy of the water measurements is that the four points in the diagram representing the total water consumption follow Willans' law exactly, that is, they lie upon one straight line. In conclusion he says that the figures show unusual excellence and economy and rank among the best obtained in direct driven dynamos by condensing machinery; the construction allows the advantage of superheating to be carried to the fullest extent without any chance of injury, and he thinks this wise use of superheating has contributed to the exceptionally good results; up to 35 h. p. the steam used without superheating was the same as with superheating, but the difference greatly increased until at 100 h. p. it was about 8 per cent.; he believes that the actual water consumption must have been about 10 per cent. less than it would have been without superheating, and that even without superheating the motor would show very good results; the governor appeared to control the engine in a satisfactory manner.

Cable Rupture by High-Tension Alternating Currents.—The Lond. "Elec. Rev.," July 7, reprints from an American journal a description of the rupture in a double cable at the Sibley College, and in response to the request of Prof. Ryan to publish facts known to different parties, it describes an apparatus which appears to have been used at the Deptford station; the object of the device is to prevent rupture of the cable in case an abnormally high momentary potential exists, such, for instance, as that on breaking the circuit; it consists essentially of two vertical brass cones, points upward, separated from each other by the required distance to allow the spark to jump from one to the other at their bases; the arc produced will, as is well known, travel upward, and as it approaches the points of the cones will become longer and longer, finally extinguishing itself; their surface should be large, and the amount of metal sufficient to cool the spark; the apparatus is illustrated in that journal.

Large Gas Engines for Electric Lighting.—According to the Lond. "Elec. Rev.," July 21, an English firm is constructing a gas engine for 650 h. p., which will be the largest single gas engine in the world. The company thinks there will be no difficulty in constructiug them of 1,000 to 1,200, by using duplicating cylinders, but it is thought that engines of 250 to 500 h. p. will be found more suitable and convenient to handle. With the cheap gas used it is claimed that the average consumption of fuel is considerably under one pound of coal per horse power per hour, and the labor required for attendance is no more than for ordinary steam engines; extra lubricating oil is required.

WIRES, WIRING AND CONDUITS.

Submarine Telegraph Cables.—The Lond. "Elec. Rev.," July 21, gives a short description of the submarine cable which Mr. Preece referred to in his recent inaugural, and with which he claims that the working speed across the Atlantic may be quadrupled. The speed of working, he claims, follows a distinct and definite law, expressed by the formula: Speed of waves $= a\,K\,R$, in which K is the total inductive capacity and R the total resistance; he states that he found by experiment that the value of K can be very materially modified by the influence of the mutual induction between two parts of the circuit, when the circuit is metallic and the core compound; the geometrical relations between the insulator and the conductors can be so modified that K can be practically eliminated; he therefore proposes to make the circuit entirely metallic and to construct a core of two conductors so arranged as regards geometrical form that the mutual induction of the two conductors shall oppose and neutralize the effect of their inductive capacity. A number of cuts are given showing merely a cable containing two conductors of various shapes and in various positions relative to one another.

Wiring.—In Mr. Carter's serial in the Lond. "Elec. Rev.," July 21, he gives some formulæ for the heating of bare and insulated wires, as also the following formula for alternate current lines:

$$w = \frac{2\,n\,K\left(V - \frac{v}{2}\right)}{10^6},$$

in which w is the number of watts which are apparently, but not really, supplied to the line, and which, if deducted for the product of the volts and the ampères supplied to the line will give the true watts supplied; n is the frequency, K the capacity in microfarads, V the voltage of supply, and v the drop over the entire line.

Useful Formula.—Mr. Hunt, in the Lond. "Elec.," July, gives the following formula, based on 1,000 ampères per inch for round copper wires:

Square root of current $= 28 \times$ diameter in inches.

Cable Coupling.—"Ind. and Iron," July 21, gives a short, well-illustrated description of the Bowden coupling for high-tension cabling, mentioned in these columns some time ago.

ELECTRO-CHEMISTRY.

Electrolysis of Sulphuric Acid.—The Lond. "Elec. Rev.," July 21, refers briefly to the experiments of Kuriloff, from which he found that the amount of hydrogen peroxide produced during electrolysis was very small; that both the peroxide and the persulphuric acid may be formed simultaneously at either electrode, but that the former is not always accompanied by the latter; their production depends on the degree of concentration, mixtures containing 3.47 of water and 73 per cent. of the acreous acid respectively behaved differently from other mixtures.

Electrolysis of Steam.—The article mentioned in the Digest last week is concluded in the Lond. "Elec.," July 21; the conclusions are given under the heading of short sparks, medium sparks and long sparks, a table of results being given under the first heading; there is also a cut showing the construction of the apparatus.

Electric Purification of Water.—"L'Elec.," July 15, describes briefly a method of purifying drinking water, consisting in passing a current between negative plates made of carbon and positive plates of iron, the action of the current being to dissolve a portion of the iron in the form of a higher oxide, which floats on the surface of the water, and which re-acts very energetically in precipitating organic materials in the water; the water is made to flow through the tank perpendicular to the planes of the parallel plates and is filtered after being electrolyzed; one ampère-hour purifies one cubic metre of water.

White Lead by Electrolysis.—According to the "Chemiker Zeitung," No. 16, page 323, white lead may be made by electrolyzing a solution of nitric acid in water between lead anodes, the lead salt which is formed being precipitated as true white lead by means of a stream of carbonic acid gas; any silver which the lead may contain is deposited on the cathodes, where it may be recovered.

Production of Carbolic Compounds.—The Lond. "Elec. Rev.," July 21, refers briefly to an apparently successful method of electrical manufacture of such compounds.

Electric Preparation of Manures and Dyeing Mordants.—The Lond. "Elec. Rev.," July 21, contains a short note on this subject.

MISCELLANEOUS.

Electric Heating.—In describing the new method of electrical heating, referred to a number of times in these columns, and consisting of passing a current through an electrolyte sufficient to heat the cathode, Mr. Leroy, in "L'Elec.," July 8, states that when a cathode of carbon is used the heat is so great that fragments of amorphous carbon detach themselves, from which it is estimated that the temperature attained 4,000 degrees C.; the inventors claim to have reached a temperature of 8,000 degrees; it is stated that experiments are being made at the Krupp factory, in Germany, with the application of this method to the superficial tempering of cannons; it is also suggested to apply it to the reduction of metallic oxides and in their separation from the ores; owing to the fact that hydrogen is evolved at the pole which is heated, the metal is cleansed by the action of the current, and the process may therefore be applied with advantage to welding. He calls attention to the fact that the phenomenon is not new, as it was described two years ago in a book by Prof. Leblond (it is therefore not patentable in this country), from which work a number of paragraphs are quoted; from these it appears, among other things, that the heat can be developed at either the positive or the negative pole. A short abstract of this article will be found in the Lond. "Elec. Eng.," July 21, which, however, contains little that has not been given here.

Movable Boring Machine.—Lond. "Elec. Rev.," July 21, describes and illustrates a portable boring machine consisting essentially of an electric motor supported either on wheels or by a chain from a crane and connected with the boring tool by means of a shaft having two universal couplings; the maximum power required is less than 1 h. p., and it will bore with ease holes 1⅛ inches in diameter; the weight of the complete apparatus is 539 pounds, that of the boring apparatus being 242 pounds, consisting chiefly of the support for the drill; it is manufactured by Messrs. Ganz & Co., of Budapest.

Treatment of Cancer by Electrolysis.—The Lond. "Elec. Rev," July 21, reprints a paper by Dr. Parsons from the "Medical Weekly," in which the disease and the medical treatment are described in detail. The electrical treatment seems to be entirely painless and very successful; in eight cases to which he has applied this treatment it proved to be a complete success in every case, even though in one case the patient was a man of 80 years; one application from a quarter to half an hour is sufficient for a small ulcer.

Marking Meat by Electricity.—Referring to this process (see Digest, July 29) the Lond. "Elec.," July 21, states that a doubt arose whether the electrical marking would hasten decomposition, and experiments were therefore made which appear to show that practically there was no difference between two pieces, one marked and the other not, the electrically marked piece being perhaps slightly the better.

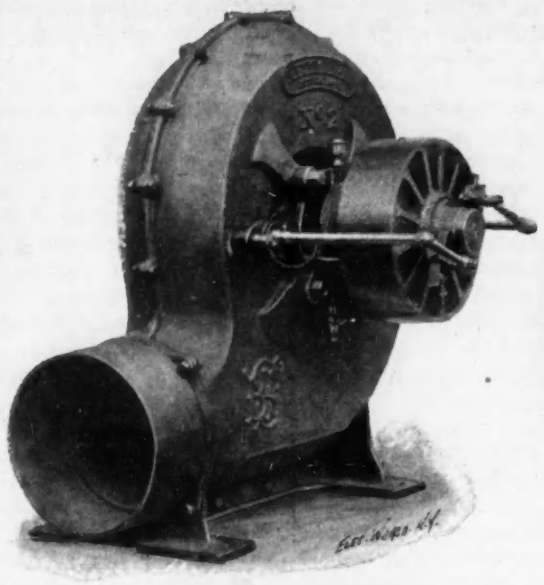
Auto-Conduction.—The experiments of Dr. d'Arsonval, mentioned in the Digest last week, are described more fully in "L'Elec." and "La Lum. Elec.," July 22, the latter containing two illustrations, which, however, show only a man and an animal inside of a large coil.

Lightning.—The Lond. "Elec.," July 21, mentions a number of fatalities recently produced by lightning.

Prizes.—"L'Ind. Elec.," July 10, reprints in abstract the conditions for the competition for a number of prizes offered by the Industrial Society of Mulhouse for electrical articles and inventions. "L'Elec.," July 15, publishes those for the prizes offered by the Industrial Society of Northern France, of which, however, only a few are for electrical articles.

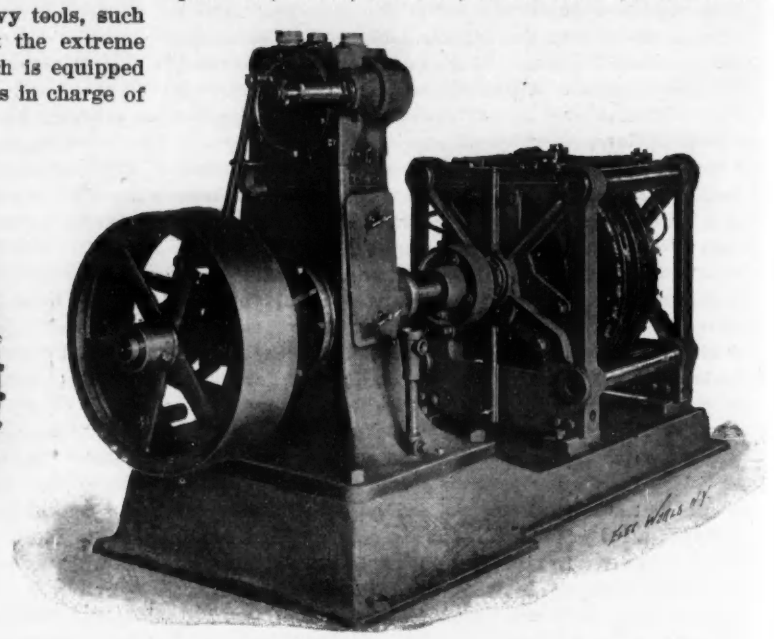
A New England Electrical Manufactory.

Order and evidence of minute attention to details never fail to produce a good impression on even a casual visitor to a workshop, and when a further insight shows that the first is the result of a carefully thought out and comprehensive system, and that the latter springs from an earnest desire to produce results of the highest technical character, professional esteem is won over, and even the spirit of commercial rivalry tempered, should the visitor be a competitor. In an extensive industry there is abundant room for a firm whose motto is technical excellence, and this apparently is the governing principle of the Waddell-Entz Electric Company, whose factory at Bridgeport, Conn., we recently had the pleasure of visiting.



A BLOWER MOTOR.

WADDELL-ENTZ ARMATURE.



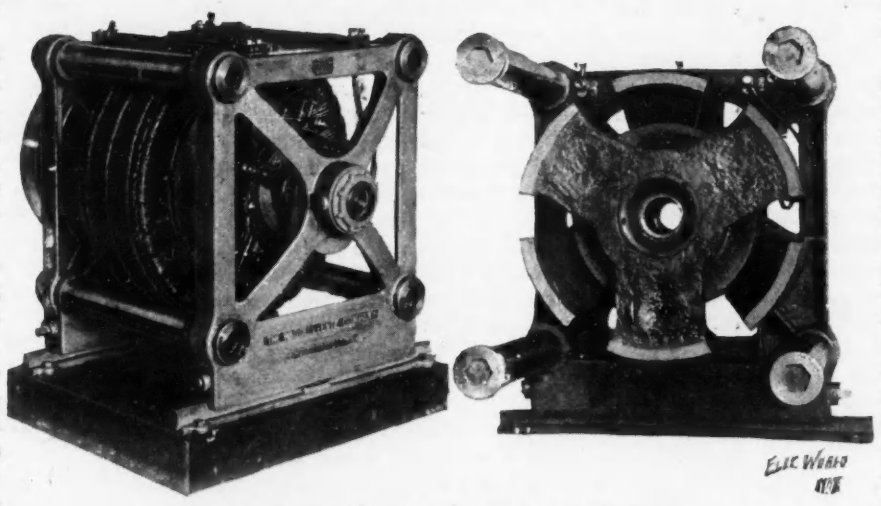
DIRECT CONNECTED DYNAMO AND ENGINE.

We give a view of the exterior of the large main building of the factory, which from its location enjoys not only admirable shipping facilities, but the advantage of one of the most intelligent labor markets in the United States. Besides this main building there are extensive additions in the rear whose use will be referred to later.

The first evidences of the system and organization that characterize these works are met with in the neat offices, and strikingly so in the tool and stock rooms, which are next entered. In the tool room the various tools are systematically arranged, and one can only be taken out upon presentation of a check, which replaces the tool or jig, and thus serves as a receipt, the check of each workman having a different number. The condition of the tool when returned serves as an indication of the skill of the workman, and it is placed in working condition again by one of the tool keepers before being replaced. Stock is also served out from this room upon presentation of an order from a foreman, and a daily report is handed in, showing what stock has been served out and the amount on hand, thus permitting an intelligent outlook to be kept and purchases made to the best advantage. Owing to the system devised by Mr. Waddell, the general manager, all of this order is maintained with not only no extra expense, but with an actual saving.

The light machine department is next entered, of which we give a view. In this department, as well as in all others, the machinery is new and of the highest grade and carefully selected for the special work required of it. Here we first notice the extensive use of jigs, which are used in every department, so that all similar parts of the machinery manufactured are interchangeable, and repair parts can be ordered from the factory with absolute assurance that they will be an exact fit.

On the ground floor are located the heavy tools, such as planers, large lathes, presses, etc. At the extreme end of this floor is the testing room, which is equipped for exact testing work. This department is in charge of Mr. Theo. B. Entz, and we notice that a systematic record on appropriate blanks of all tests is kept. Every electrical apparatus is thoroughly tested here before it leaves the works; nothing is taken for granted, and a trifling defect is as carefully considered as one of magnitude. Water testing resistances are not used, as it has been found that the exactitude of tests desired can be better obtained and controlled by wire resistances. Among the instruments we noted, Queen & Eliot resistance boxes, Schuckert, Patterson & Cooper, and electrodynamic ammeters and voltmeters, Greeley testing instruments and a fine deadbeat German galvanometer, as well as tachometers and other testing appliances. An interesting contrast is presented between one of the lofty old Edison dynamos and, in comparison, a pigmy Waddell-Entz dynamo; the former is rated at 6 k. w. at 2,000 revolutions and the latter at 12 k. w. at 575 revolutions, and the same disproportion exists inversely in the efficiencies.



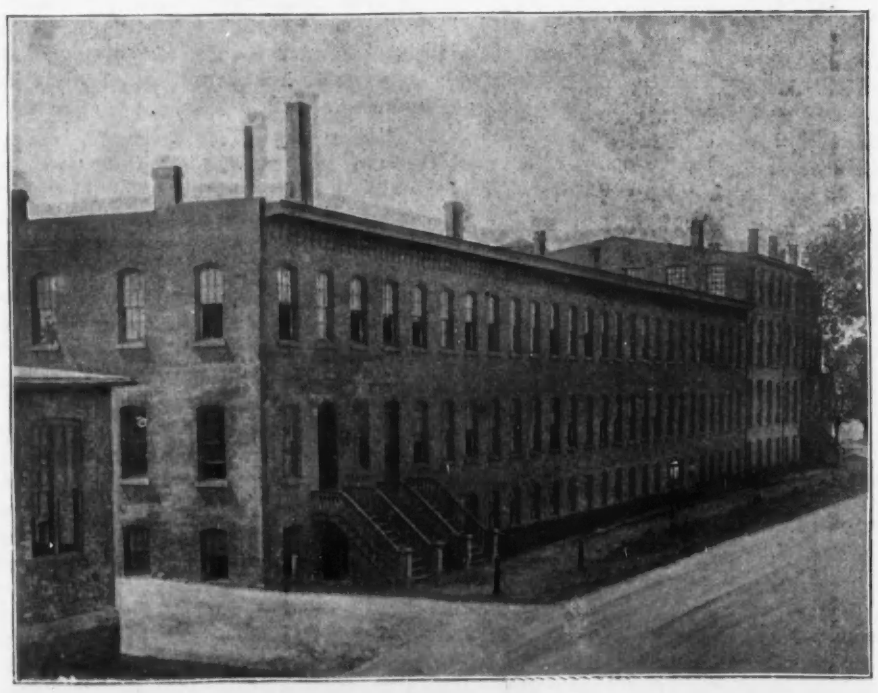
12-K. W. DYNAMO AND FIELD SPIDERS.

The designing department, with a pattern shop adjoining, is on the top floor, the former being in charge of Mr. V. H. Hewes, C. E. In the draughting room everything is conducted with the same system as in the other departments, and a feature is the classified collection of photographs and negatives of new or special types of apparatus. On this floor is also the storage battery department, which, however, is forbidden ground to the outsider. As a special favor we were given a glimpse through a door, and noted particularly a long line of the special machines employed in the fabrication of the negative storage battery element.

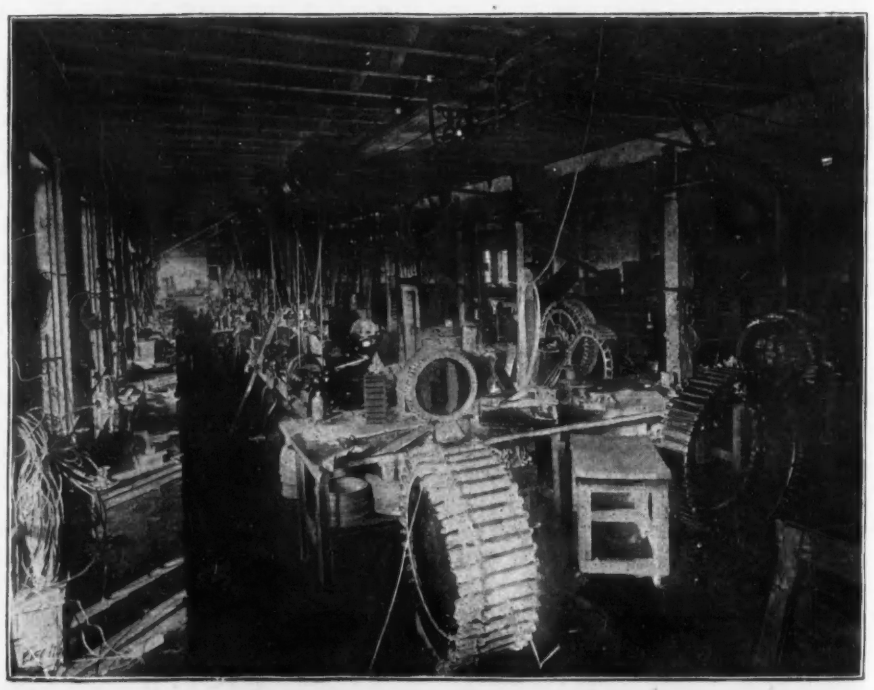
In the rear of the main building is a large testing room for the trial of the large combined engines and dynamo sets, for which this firm is noted. An illustration of one of these is given in The Electrical World of July 29.

In another detached building is the brass foundry, where not only all the brass electrical castings are made, but also aluminium and manganese bronze dies for artistic work. This is a side specialty, and the jewelers' embossing and other dies made by this firm for artistic work have already established themselves in the market. Some of the brass dynamo castings made here, particularly the large armature rings, are quite intricate, and yet come out of the sand in admirable condition. The commutator segments are particularly clean looking, and only require a slight milling on one side before being used. These segments can be bent back on themselves without breaking, and those we examined appeared to be very close grained without the sign of a flaw anywhere.

The dynamos made by this firm vary in size from ¼ k. w. to 80 k. w., and the motors only differ from the dynamos in not having the field compounded, the street car motor excepted, which is of a special type. Figs. 1, 2 and 3 show very clearly the construction. There is only one field coil which is central. The field frame consists of two spiders; one of these carries the magnet core and the other fits on the turned end of this core. The field coil is entirely shielded from any injury by the two spiders, which together completely enclose it. It may be here remarked that the commutator is similarly shielded by the outer frame, but in which there are ample openings for adjustment of the brushes if necessary. The ends of the spider arms are turned at right angles, and when in place these alternate, so that, viewed at right angles to the armature shaft the ends form equal-



FACTORY BUILDING.



LIGHT MACHINERY DEPARTMENT.

ly spaced symmetrical poles. The poles connected to one spider are all norths, and those connected to the other all souths, but from the arrangement the norths and souths ends alternate beneath the armature. In the smaller dynamos a spider has two arms, or rather a single arm, projecting on each side of the magnet core, making consequently four poles. In the largest size the spiders have five arms and ten poles. The armature is shown in Fig. 3, and also in the inside shop view. It is built up of soft sheet iron segments which are held together by a metal ring on each side, the brass bolts of which do not pass through, but clear, the outside and inside of the armature, thus completely avoiding Foucault currents and also serving to space the Gramme winding. The greatest pains are given to insulation and the company prides itself upon its immunity from burnt out or defective armatures. In order to be absolutely sure in regard to the insulation of the wires, all wire is bought bare and covered in the factory. A special process is used in regard to insulating the armature frame, all moisture being withdrawn from the covering by passing a hot iron over it.

Great attention is also given in the construction of the commutators, the segments of which are covered on the bottom and sides with a continuous sheet of mica, thus preventing any possible defect at the bottom of the segments.

The poles of the field are turned true, and the armature so truly made that when in place over the poles the air space can be made very small.

From the description it is plain that the magnetic circuit is from a pole of one spider through the armature to the adjacent pole on the other spider. The sections are not cross-connected, but there are as many brushes as poles, following the practice that has grown up since the introduction of carbon brushes.

Among the mechanical advantages of this dynamo are its great compactness and the manner in which the parts liable to injury are shielded. The field coil is entirely inclosed; when desirable the armature is covered with a brass shield, and the motors are generally thus supplied. The illustration of a motor connected with a blower shows one of these shields applied, which, together with the symmetry of its form, gives the machine a remarkably neat appearance.

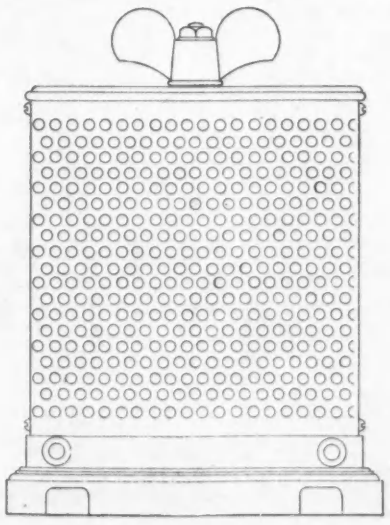
Owing to the symmetrical form of the machine, as well as to the manner that it may be protected from injury, it is peculiarly adapted as a motor for connection to machine tools and special uses; one of the many applications is to a rotary pump, where it is very effective. Owing to the slow speed the dynamo is largely used in direct connection with an engine, the armature being fitted on the engine shaft, replacing one of the flywheels; the compactness and form of the field give the combination a mechanical appearance. We illustrate a dynamo directly connected with a Case engine, and have referred to another case recently illustrated in these columns.

The following table gives the speed and number of poles of the different sizes of dynamos:

Kilowatts	2	3½	5	8	12	20	30	50	80
Number of poles	4	4	4	4	6	6	8	8	10
Revs. per minute	900	9,000	750	650	550	410	310	275	220

Recent sales have been of large direct connected generating sets to hotels in Chicago and Philadelphia, and a similar one is now being built for the Metropolitan Club, of New York. Readers who may have the opportunity will do well to visit the fine storage battery plant of the Second Avenue street railway, where Waddell-Entz storage battery cars are also used, and the "Mail and Express" building to see the extensive motor service there in use.

The various officers of the company are as follows:



Percival Knauth, president; Montgomery Waddell, vice-president and general manager; A. A. Whitman, treasurer; J. A. Machado, secretary; J. B. Entz, technical superintendent. Executive force at factory: W. A. Phillips, storage battery department; V. H. Hughes, C. E., designing department; A. Van der Linde, assistant to general manager. Executive force, New York office: T. H. Foote, superintendent Second avenue storage battery plant; H. B. Coho, general sales agent.

The Spencer Economy Coil.

Notwithstanding the rapid introduction of the Helios lamp, of which, we are informed, more than 4,000 are now in use in the United States, the manufacturers, The Helios Electric Company, 1310 Filbert street, Philadelphia, Pa., have recognized that a difficulty has been encountered by the fact that the transformers regularly in use on alternating circuits are made to convert to 50 or 100 volts secondary. An essential requirement of the Helios lamp is that it should burn at 28 volts to produce the best results, and, therefore, the only economical means heretofore of running this lamp has been by the use of special transformers to convert from either 1,000 or 2,000 volts primary to 30 volts secondary. In many instances the lamp is run on 50 volts secondary in connection with a resistance to reduce the E. M. F. to 28 volts. This method is expensive, owing to the great loss of energy in the resistance.

The Spencer Economy Coil has been designed with special reference for use in connection with the Helios lamp on the same secondary circuit with incandescent lamps. The coil is practically a secondary transformer, the current on the secondary circuit at 50 or 100 volts being converted to a pressure of 28 volts. In other words, on a 50-volt secondary circuit the coil receives a current of 6 amperes at 50 volts, and converts this to 10 amperes at 28 volts, thereby making a saving of 40 per cent. of the amount of the energy required to run one lamp on a 50-volt circuit with resistance; on a 100-volt secondary circuit the coil only receives 3 amperes, which is converted to 10 amperes at 28 volts, making a saving of 70 per cent. of the amount of energy required to run one lamp on 100-volt circuit with resistance.

Fig. 1 shows a side view of the coil ready for use, and Fig. 2 shows the top of the coil with the switch handle. The special feature of this switching device is that when the switch contact is on the point marked "start" the lamp receives 20 per cent. higher pressure than it normally requires, and the arc will pick up

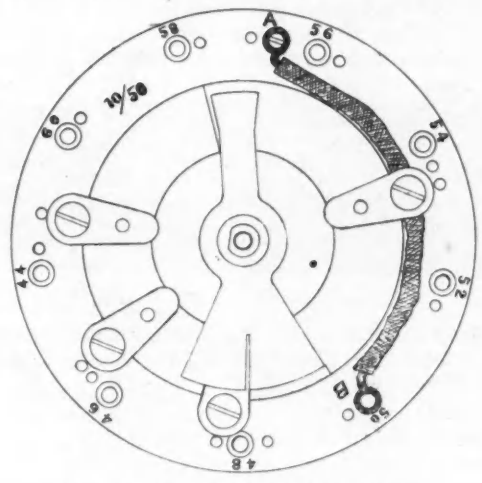


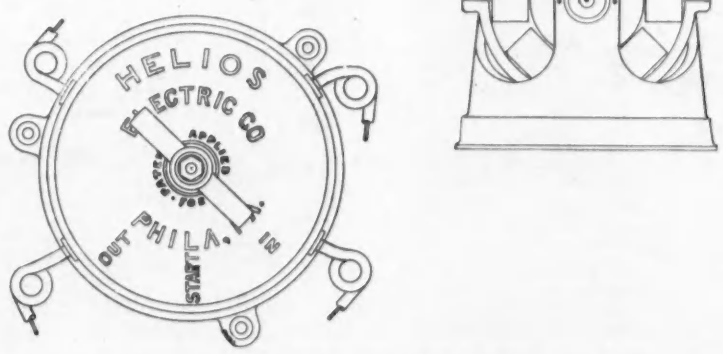
FIG. 3.—SPENCER ECONOMY COIL.

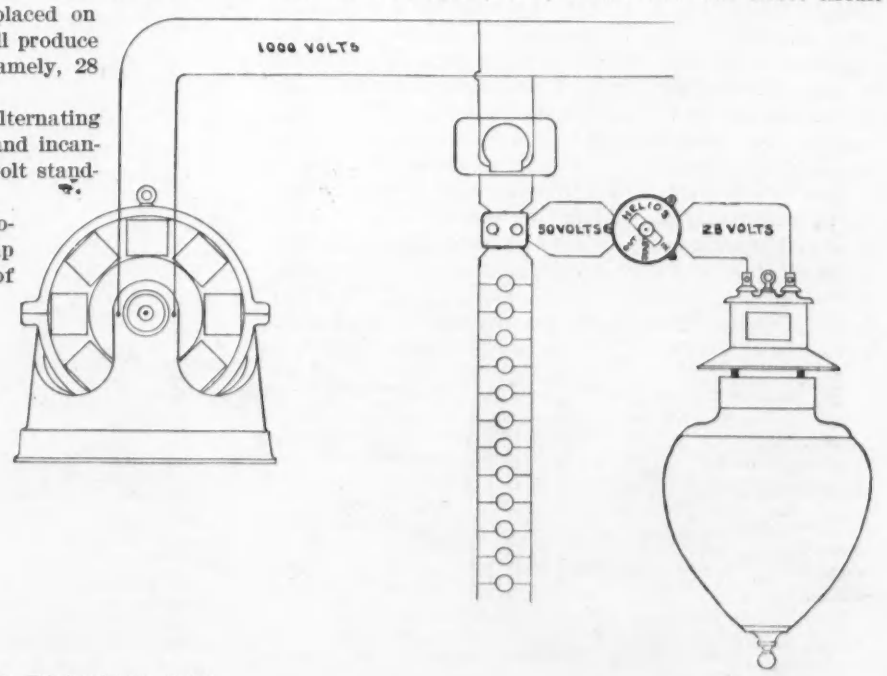
instantly; the switch is then turned to the point marked "in," which gives the proper E. M. F. of 28 volts.

Fig. 3 shows the interior of the coil with adjusting cable. The end of the cable marked A is stationary, and always remains fixed. The end marked B is the adjusting end, and is placed at any terminal point desired. Thus, if at a given place where the arc lamp is to be used, the secondary E. M. F. should be 56 volts, then the end of the cable marked B is placed on the terminal marked 56. This will produce the desired result at the arc, namely, 28 volts.

Fig. 4 shows a complete alternating current system where both arc and incandescent lights operate on a 50-volt standard transformer.

By the use of a Spencer Economy Coil a 1,500-c. p. arc lamp only requires the same amount of energy as 5½ incandescent lamps of 16 c. p., and a 2,000-c. p. arc lamp only requires the same amount of energy as 7½ incandescent lamps of 16 c. p. The same meter for incandescent lamps correctly registers the current consumed by the arc lamps, and it will be further seen that there is no change required in the secondary wiring, nor does it require a large outlay for a special transformer. The arc lamp, in connection with the coil, may be hung on any incandescent secondary circuit without, of course, any additional expense for special wiring, special transformers or special meters, at the same time allowing all the advantages of running the arc in parallel, both as regards steadiness and their being independent.



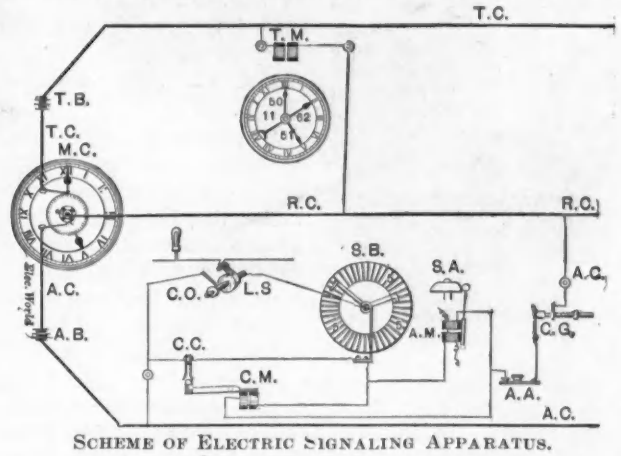


FIGS. 1, 2 AND 4.—SPENCER ECONOMY COIL.

The combination of this coil, the Helios lamp and the special 28-volt carbon, the latter of which suppresses nearly all the noise from the arc, produces a system which is a worthy rival to its continuous current competitor.

A New Electric Signaling Apparatus.

A new electric signaling apparatus, recently invented by Mr. Wesley Trafford, of New York City, is a useful addition to that class of novelties which add comfort and



SCHEME OF ELECTRIC SIGNALING APPARATUS.

convenience to the traveling public. This new time-call system is employed in producing signals in the rooms or apartments of such large establishments as hotels, factories, flats and similar buildings, wherein the signal is conveyed to the several rooms from a central station or main office by means of an electric circuit, controlled by a clock both as to the time and duration of the alarm. By means of a cut-out device the main electric circuit current is rendered ineffective in each sub-station apparatus when its alarm indicating pointer is at the neutral or unit point. To the general circuit is attached a fire-alarm call, an annunciator system, an automatic electric light switch and electrically controlled clocks. This invention can be used with any electric time system.

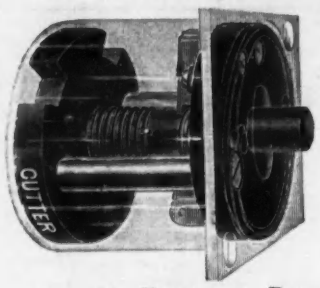
A diagrammatic illustration of a single system is represented above. The electrical impulses are governed by the rotary switch that is fast upon the shaft of the minute hand of the central station clock, M C, to which shaft the return circuit line wire, R C, is attached. The switch has a number of insulated points which provide between them conducting points to the number required, sixty if the electric impulses are to be made each minute. When the spring contact arm rests upon the conducting surface of the rotary switch electric impulses will be sent from the batery, T B, through the line wire, T C, thus energizing the magnet, T M, and operating the escapements of the clock part of each sub-station, producing step-like rotary movenemts of the clock pointers.

Referring to the figure, one arm on the switch, S B, is set at the desired hour and the other arm is moved by the electrical time escapement. When the two arms come on the same segment, which may be spaced for half or quarter hours, the current is closed; the current then acts on the magnet, C M, which closes the direct circuit at C C, and the current passes through the bell to the return wire, R C. On a continuation of the shaft of S B is C O, on which are two cylinders; the smaller one has a portion of its surface non-conductive, so that the apparatus will not be actuated when the alarm hand is not set, and the larger one is to light an electric lamp when the alarm is rung. By means of A A the alarm is stopped. C G automatically opens the circuit when the alarm is being set to avoid having the alarm rung during this

operation. T M is the magnet of the electrical escapement whose clock face and hand for setting alarm are shown below, its arbor being the same as that of S B and C O. It is understood, of course, that these parts all fit compactly in one case.

Cutter's Economic Door Switch.

Economy in the use of current for lighting purposes hinges largely on the devices for readily turning it off or on just as it is needed. In most cases some lights are used much more than necessary, while other places are not fitted up at all owing to the risk of increased consumption of current. This is particularly the case with closets, store-rooms, and the like, where the light is needed very rarely and the servants are apt to leave it turned on when not required.



Cutter's Economic Door Switch.

A simple device, which obviates this, would evidently save current and make the lighting of odd corners inexpensive, and the Economic door switch has been devised by George Cutter, of Chicago, for this and other purposes. This new switch is set flush in the rabbet of the door jamb so that the door itself presses against the projecting button. On opening the door the light is turned on and burns until the door is closed, when the switch shuts it off. There is thus no need of hunting for the switch in the dark, or of remembering to turn it off when leaving, neither can any current go to waste when the door is closed. The saving in current and in the life of the lamps is worth considerable, to say nothing of the great convenience of such devices.

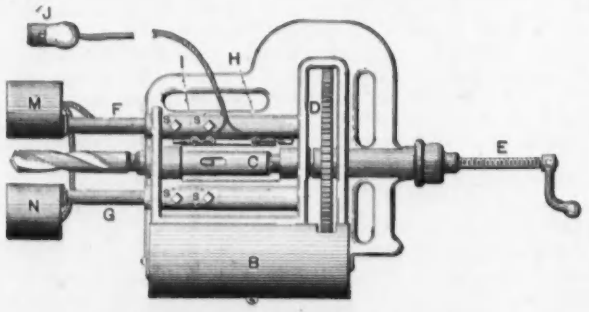
As the cut shows, it has a cylindrical casing, so that a hole bored into the door jamb is the only fitting required. The switch itself has a positive spring action, and has hard rubber insulation throughout.

A Magnetic Electrical Drill.

The great adaptability of the electric motor for shop work is rapidly becoming recognized, and the machine we illustrate is a marked step in advance besides being more than usually interesting from the principles involved. While applicable to numerous classes of work, it will prove of especial value for boiler and structural work, as well as in shipyards and for use aboard ship.

This machine is designed by the Belknap Motor Company, of Portland, Me., and is being introduced by them to take the place of the old familiar ratchet drill, and to a large extent also to do the work of the upright and of the radial drill, and thus to avoid the old tedious and time-wasting method of dragging a heavy casting across the shop to place it accurately under a fixed machine, and after performing the operation to return it to its former place. The electric drill can be carried to any part of the shop as easily as a ratchet drill, and can be applied to any part of the work very much quicker and easier.

The attachment of the drill to a piece of ironwork only requires the turning of a switch. Referring to the accompanying cut, the framework, A, is one casting, and forms the support for the motor and for all the working parts. The motor is entirely inclosed by the metallic case, B. The spindle, C, is fitted to receive the taper shank of large drills, and the smaller drills may be used in a chuck. The large gear, D, receives power from the motor and drives the spindle, C, by means of a sliding feather, and the spindle is moved backward or forward by the feed screw, E, with handle attached. The frame, A, has two sockets for the reception of the two stems, F, G, which may be slid in or out to different positions and secured firmly by set screws, S, S, S″, S. M and N are two iron clad electromagnets attached to the stems, F, G, and are controlled by the switch at H. The current for operating the motor is controlled by the switch at I.

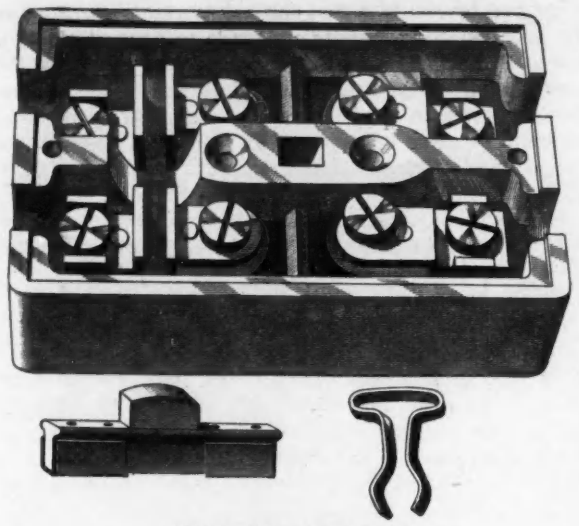


A Magnetic Electrical Drill.

The machine may thus be placed in position and secured before starting the motor, the two operations being entirely independent of each other, although but one cord is used and one plug, J, for attachment to the nearest lamp socket. The adhesive force of the magnets, M, N, is made ample by the proper proportioning of the magnets to the size of drills intended to be used. It is found practicable to require of them a force of 150 pounds per square inch of cross section. The drills now being made are for use on ordinary 110-volt lighting circuits.

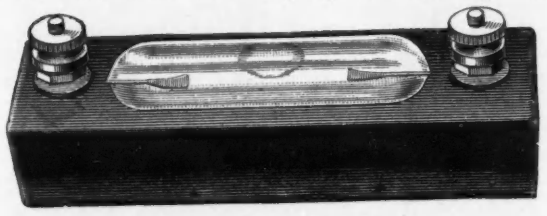
A New Cut-Out and Pole Indicator.

The Imperial cut-outs which have just been introduced by the Imperial Manufacturing Company, 323 Washington street, New York, have been designed to meet the strictest requirements of protection against fire—safety being the first consideration. The insulation is all of porcelain or mica, no metal parts in circuit being exposed. Every branch taken from the cut-out has its own fuses, and all connections are on the face of the block. It will be seen upon examination that all parts of different polarity are carefully insulated from each other, and each fuse is confined in a separate compartment so that all possible danger of trouble in the cut-out is avoided. Between the fuse terminals the porcelain base is depressed, with a ridge in the centre to support the fuse in case it should sag.



IMPERIAL CUT-OUT

Fuses which touch the base of the cutout for a considerable portion of their length cannot be depended on, as the heat conducted away by the colder porcelain largely increases the carrying capacity above the normal. The construction shown enables the fuse to operate at its proper fusing point.



Imperial Pole Indicator.

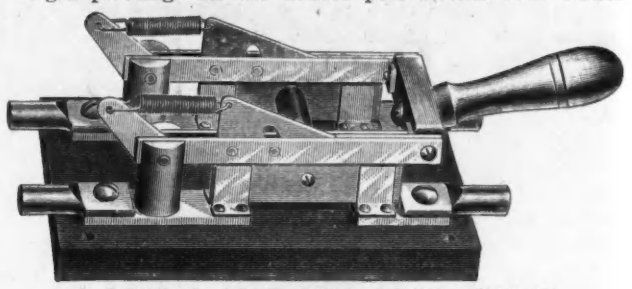
A double pole plug switch in each branch of the cutout, shown below the cut-out, enables the current to be broken, and the fuses can be inserted without trouble. It likewise affords a convenient means to disconnect any circuit for testing or when not in use, and it can be used to cut off lights instead of a switch.

It will be noticed that the cover can be conveniently attached by means of the spring attachment shown below the cut-out, permitting its ready removal without the use of a screwdriver.

The novel pole indicator we illustrate can, we are informed, also be used as a level, being accurately adjusted for this purpose. When placed in circuit the negative pole of this instrument, as well as the adjacent liquid, will quickly be colored a bright red, which disappears when the indicator is shaken. The indicators are made for high resistance circuits up to 600 volts, and for low resistance circuits. The latter form is so sensitive that it may be used for testing, indicating through 25,000 ohms with five-volt E. M. F.

A Double Pole Snap Knife Switch.

We have recently shown in these columns one of the new C. & H. snap knife switches, manufactured by Cutler & Hammer, 313 South Canal street, Chicago, and in the double pole switch which we illustrate herewith the same general features are observed. The grinding contact has particular advantages. The blades leave the contact clips by a different path than they enter, thus giving a very large wearing surface. No switch made, it is claimed, enjoys this advantage on account of the rigid pivoting. In the double pole switch both blades snap simultaneously, the length of the snap being equal to the distance between the two clips. The switches are absolutely rigid, and very handsome in appearance.



A DOUBLE POLE SNAP KNIFE SWITCH.

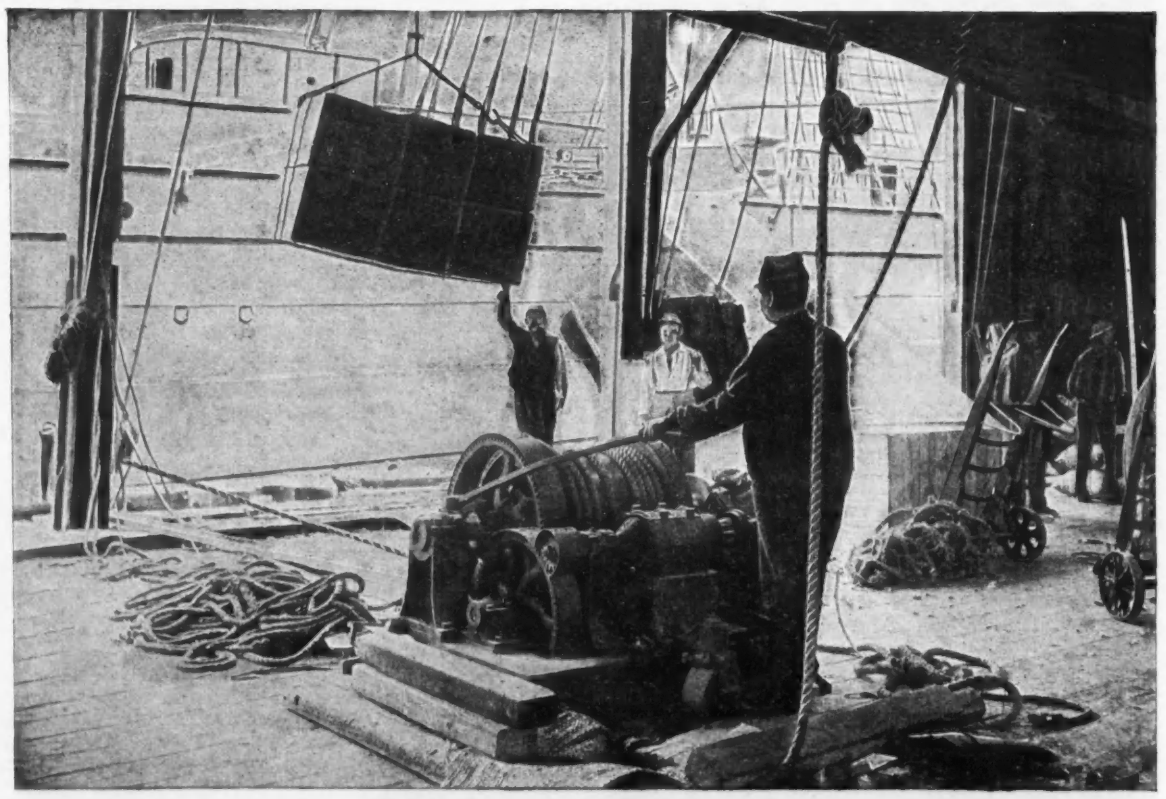
An Electric Dock Hoist.

An interesting example of an advantageous substitution of electrical power for that of steam is afforded in the installation of electrical motor hoists which have been in operation during the past two years and a half on the wharves of Sanderson & Sons, in Brooklyn, where the Wilson transatlantic steamers discharge. The installation made by Messrs. Curtis & Dean comprises nine 10-h. p. General Electric hoists of the drum and winch head type in continual use, loading and unloading the vessels which are constantly arriving and departing. The driving motors are of the well known bipolar type.

The hoists have been in operation for two and a half years and the owners would not be without them. The men are so convinced of their many superior features that any proposal to return to steam hoists would arouse an active protest. The hoists have so completely accomplished every duty they have been called upon to perform that the installing company has yet to hear the first complaint against them. They are readily moved from place to place on the wharves or upon the vessels themselves, wherever they may be needed, require little or no attention, and are made ready for service by the mere connection of the conductors to the service wires.

Perhaps the most important feature emphasizing the superiority of these electric hoists over their predecessor, the steam hoisting engine, is that of repairs. During the two and a half years in which these hoists have been under continual daily duty, the total cost of repairs has amounted to the phenomenal sum of $24.75, or $2.75 average for each hoist. It may be doubted whether any such fact as this has ever been recorded about a steam hoist.

This installation is by no means exceptional. Electric hoists are superseding the steam hoist, not only in marine and wharf work, but in factories, mines, engine shops and other places where economy, rapidity of work and perfect operation are requisite.



AN ELECTRIC DOCK HOIST.

"The Electrical World" Candelabrum.

Owing to an unfortunate loss in the mails we are only at a late day aware of a pretty compliment paid to us by the New Jersey Lamp and Bronze Works, of New Brunswick, N. J., in naming a handsome electro-bronze candelabrum after The Electrical World.

The design, which we are enabled to illustrate, has been happily chosen, as "Liberty Enlightening the World" can indeed be typified by The Electrical World, which

"THE ELECTRICAL WORLD" CANDELABRUM.

finds its way to every part of the globe and whose liberty of action and enlightened views are everywhere recognized and appreciated.

The Electric Storage Battery Company's Battery.

The correspondence published in The Electrical World of last week in reference to the battery of the Electric Storage Battery Company, of Philadelphia, has a technical value from the very full particulars of the battery embodied.

As will be seen by reference to the report of Prof. Chandler, accompanying the correspondence, the plates are cast of a fused mixture of chloride of lead and chloride of zinc, and then have a rigid metallic rim cast about them to give strength and protection from injury. The plates are next immersed in a bath of chloride of zinc or some equivalent substance in connection with a slab of metallic zinc, which results in the withdrawal of the chlorine of the chloride of zinc and of chloride of lead, and fixing it in combination with the zinc slab, forming chloride of zinc.

After this operation the plates are ready for immediate use in the same manner as ordinary formed Plante plates, the preliminary process taking the place of the long Plante operation in forming the plates.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Aug. 5, 1893.

GENERAL ELECTRIC gained some 15 points as a result of the week's trading. The talk of a receiver for this company is now altogether out of question. A week ago the stock was knocked down to 30 on what seemed an endless outpouring of stock from investors' strong boxes. There was seemingly ample ground for the belief that the financial troubles of the company were of such an aggravated nature as to eventually necessitate a recourse to the courts for protection from creditors. Wall street did not count upon the faith which the big men identified with the General Electric Company who had a chance to be fully acquainted with conditions had in the future. It is rare in Wall street history to find a syndicate stronger than that which has been formed to underwrite the securities in the General Electric's treasury as offsets against its floating debt. To the bankers enumerated in these columns last week has been added the house of Kidder, Peabody & Co., of Boston, who underwrite $600,000 of the purchase price of the $9,500,000 treasury securities of the General Electric Company. This is of the greatest importance, in that this banking house has never been identified with the property. The interests of this house are the same as those of Baring, Magoun & Co., of New York, and they represent in the East an immense capital at the disposal of Baring Brothers of London. The presence on the list of subscribers of such names as Drexel Morgan & Co.; Kidder, Peabody & Co.; Lee, Higginson & Co., the Old Colony Trust Company, with the wealth of the Coolidges to back it; Fred L. Ames, ex-Governor Ames, President Coffin and his wealthy associates in the management, makes the receivership talk seem a little out of place. There is seemingly good financial backing to the General Electric Company. The new trust concern which will be based on the treasury assets to be sold to this syndicate is to be called the Tramway and Illuminating Trust. Its capital is to be $4,500,000 10-year debenture 6's and as much capital stock. A semi-official prospectus of this company has it that the securities embraced in the trust are to be selected by a committee for mortgage bonds, secured short time obligations and miscellaneous railway and illuminating securities aggregating in value $10,500,000. The trust will last ten years or longer at its own option, and the bonds may be redeemed at a premium. A synopsis of the company's condition shows that the General Electric Company has on hand about $1,400,000 cash, and owed $5,000,000, including the $600,000 paid in dividends Aug. 1. From the sale of its $10,500,000 treasury certificates it will receive $4,050,000. This, with the cash on hand, will give the company $5,450,000. This seems to amply provide for not only the dividend which has been paid, but also the whole floating debt. The shareholders in the new trust will select first-class treasury assets at less than 50 cents on the dollar, and judging from the experience of the shareholders in the various Thomson-Houston Trust or series, which was similarly organized on treasury securities as a basis, they will receive their original investment several times over before the expiration of the Trust. Of course, there is no use stating that the subscribers to the underwriting syndicate were actuated by motives of philanthropy. But that the General Electric Company should make such sacrifices as it is doing can only be excused because it is absolutely necessary that the company obtain cash to liquidate a floating debt that could have been extended in these times of financial distress only upon ruinous rates. A new policy is to be followed now. The company is going to do business on a cash basis. The lesson has been a severe one, but the cost will not have been too great if the management are fully awakened to the fact that doing business on nothing but wind is likely to prove troublesome at one time or another. The committee recently appointed by stockholders to investigate the company's affairs have made a preliminary report to the effect that the company's assets are large—President Coffin says the company has $15,000,000 bonds and stocks, all the bonds paying interest and 60 per cent. of the stocks paying dividends—that the business prospects are good, and that as far as the committee can discover no reason at all exists for believing that the General Electric Company will in the future be obliged to either pass the dividend or reduce the present rate. Last week's orders are said to have been the largest in any week in June or July.

WESTERN UNION'S rise of 10 points during the past week has been occasioned more by forced covering of short contracts than by the announcement of any definite news tending to create a better feeling in the stock. The stock has been heavily sold during the past two weeks upon the well known fact that earnings have been steadily decreasing. Everything that has been made known regarding Western Union justified the belief that its quotation was bound to go lower. The bears overreached themselves, however, in their endeavor to bring about the range of prices that they deemed properly in accordance with the circumstances affecting the Western Union Telegraph Company's business, and the short interest in this stock became so unwieldy that in the attempt to make deliveries good the bears had at times to climb over one another to get sufficient stock to carry out their contracts. Premiums of one-half to three-quarters per cent. have been paid at various times during the week for the loan of the stock over night. Free selling by insiders has, however, been easily traceable on the rally, and upon every spurt sufficient long stock has come out to make it appear that the Baltimore & Ohio Railroad Company is by no means yet through with the recently begun liquidation of 50,000 shares of Western Union stock it received some years ago in exchange for its own telegraph plant. That the Western Union Telegraph Company, as well as every other business concern throughout the country is suffering from the business depression to the detriment of earnings is demonstrated by the fact that it is making heroic retrenchments in every possible way. Chiefs have been put down one grade and their salaries consequently reduced $5 to $10. Heads of departments have been given the strictest orders to economize in every possible instance, as business stagnation is affecting receipts most unfavorably. Official intimations are that the earnings for the current quarter will not make the good showing at one time expected.

THE ERIE TELEPHONE COMPANY'S earnings—this includes the Cleveland Telephone Company, the Northwestern Telephone Company, the Southwestern Telegraph and Telephone Company—for the three months ended June 30 show that after dividends and expenses of $246,450 had been paid there was a surplus of $5,051 left. The proportion of dividends received by the Erie company was $59,630. Out of this a dividend of $48,000 was paid, leaving a surplus of $11,630, making the total surplus of three months $16,681.

THE COMMERCIAL CABLE COMPANY had listed on the Stock Exchange this week $2,284,000 additional capital stock, making the total amount now listed $10,000,000, which is the authorized capital stock of the company. The issue of this balance has been duly authorized by the Board of Directors for purposes which have been approved of at stockholders' meetings. In making an application for the listing of these stocks, President Chandler officially reported that the earnings of the company for 1892 were $1,890,377; working expenses for 1892 were $762,513; interest payments called for $28,276, and dividend disbursements amounted to $540,120, making the total expenditures $1,330,909, and leaving a balance to be transferred to reserve fund of $559,467.

WESTINGHOUSE ELECTRIC STOCK was weak at one time upon the belief that the restraining orders issued the beginning of the week by Judge Ricks, of Cleveland, against the Buckeye and the Packard companies would affect its lamp business. The officials of the Westinghouse Electric and Manufacturing Company state that the real result of the decision will be to divide the lamp business entirely between the Edison and the Westinghouse companies. There are now in use 150,000 of its two part stopper lamps, and the output of these lamps will be, as a result of the demand that will be made consequent upon Judge Ricks' decision, increased from 5,000 to 10,000 per day. They hail the decision as one of as much material benefit to them as to the Edison company, as it closes out of competition factories that, while merely infringing upon Edison patents, cut also into the Westinghouse company's business. There is said to be a disposition between the two controlling interests in the electrical trade to come to some sort of a definite understanding, and it is likely that all difficulties and differences would have been settled ere this did not the personal equation enter into the matter. Neither Mr. Westinghouse nor Mr. Coffin is disposed to make the first advances, and there the matter rests. It is stated that Mr. Westinghouse has solved the problem of furnishing underground power for street car propulsion. Arrangements will soon be made, it is reported, with the Broadway Cable Company for furnishing one or two of its connecting lines with this new means of motive power. This underground current is to be furnished to the cars in an economical and perfectly safe manner by a device entirely of Mr. Westinghouse's own invention, perfected after six years' continued investigation and experiments. It is hardly necessary to add that street railway companies and electrical engineers would warmly welcome such a system.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	25	30
Detroit Electrical Works	10	2	3
East River Electric Light	100	..	65
Electric Con. & Supply Co. pref.	15	15	16
" " " " " com	15	15	17½
Edison Electric Ill., New York	100	89	90
" " " 1sts	...	99	100
Edison Electric Ill., Brooklyn	100	95	100
" " " Boston	100	115	130
" " " Chicago	100	220	230
" " " Philadelphia	100	120	140
Edison Electric Light of Europe	..	2¼	5
" Bonds	..	80	85
" Ore Milling	..	5	12
Fort Wayne Electric	..	121½	123¾
General Electric Company	100	50¾	51
" " deb. 5's	...	72	73
Interior Conduit and Ins. Co	100	30	40
Mount Morris Electric	..	..	65
Westinghouse Consolidated	50	16¾	17½
" " pfd	50	38	39
Western Union	100	76	77

TELEGRAPH AND CABLES.

	Par.	Bid.	Asked.
American District Tel	100	54¾	55
American Tel. & Cable	100	70	73
Central & So. Am. Tel	100	..	111
Commercial Cables	100	137	138
Gold & Stock Tel	100	100	103
Franklin	100	35	40
Mexican Telegraph	..	180	200
Northwestern Telegraph	...	102	104
Pacific and Atlantic	...	50	60
Postal Tel. & Cable	...	...	70
Southern & Atlantic Tel	25	75	82½
Western Union	100	78¾	79

TELEPHONE STOCKS.

American Bell	...	180	183
Erie Telephone	...	38	40
New England Telephone	...	48	48
N. Y. & N. J. Telephone	...	90	95
Metropolitan Tel. & Tele Co.	...	200	....

AFFAIRS OF THE COMPANIES.

THE NATIONAL ELECTRIC MANUFACTURING COMPANY OF EAU CLAIRE, WIS.—The assets of this company will be sold by the receiver at Eau Claire on Sept. 4, 1893.

THE BUFFALO ELECTRIC LIGHT AND POWER COMPANY has elected George Urban president and James A. Roberts vice-president. Mr. Henry Koons was given full power to negotiate with the Niagara Falls Brush Electric Light Company for the purchase of their plant.

THE MUNICIPAL ELECTRIC LIGHT COMPANY held its annual meeting Aug. 1 in the company's office, 126 Broadway. A full vote was polled, resulting as follows: Matthew Dean, John Hills, James L. Jensen, G. Edward Graff, Clement Lockitt, Ezra D. Bushner and Bernard Gallagher.

THE DES MOINES (IOWA) EDISON LIGHT COMPANY has elected the following officers for the current year: Mr. John I. Beggs, of New York, president; Mr. J. H. Herrick, of New York, vice-president, and Mr. J. A. Colby, the general manager of the company in Des Moines, was elected secretary and treasurer.

THE HYDE PARK (MASS.) ELECTRIC LIGHT COMPANY has elected the following officers: President, James D. McAvoy; treasurer and clerk, Thos. T. Robinson; directors, James D. McAvoy, John T. Robinson, Galen L. Stone, John R. Bullard and Thos. T. Robinson. The treasurer was authorized to enter into negotiations for furnishing the power to the street railway company.

A BIG DEAL.—The Edison Illuminating Company, organized in St. Louis two years ago, has absorbed the Missouri Electric Lighting and Power Company and the Municipal Electric Lighting and Power Company. In the very near future the incandescent wires of the Municipal will all be switched to the Missouri power house and the arc plant of the Municipal be run by the Edison concern.

NEW INCORPORATIONS.

THE WEST END ELECTRIC LIGHT COMPANY, Luzerne, Pa., capital stock $10,000, has been formed to supply light, heat and power. The promoters are J. C. Haddock, T. R. Phillips and Geo. W. Shouk.

THE HOME INVESTMENT AND REALTY COMPANY, Butte, Mont., capital stock $200,000, has been formed for electric lighting and storage, etc. J. B. Read, J. H. Montieth and Frank S. Smith are interested.

THE ELECTRIC BURGLAR ALARM COMPANY, Chicago, Ill., capital stock $250,000, has been formed to manufacture and sell burglar alarms and electrical goods. J. Lindheimer, Geo. D. Hoffman and J. S. Hoffman are interested.

THE PENNSYLVANIA TRACTION COMPANY, Lancaster, Pa., capital stock $10,000, has been formed to construct and operate motors, etc. Robt. McMeen, S. M. Patterson, J. D. Skiles, J. H. Brown and J. J. Patterson are interested.

THE HOLT ELECTRIC INDICATOR COMPANY, New London, Conn., capital stock $15,000, has been incorporated to manufacture indicators, electrical apparatus and instruments of precision. G. B. Prest, Chas. F. Holt and Wm. S. Stare, all of that city, are the organizers.

THE SOUTHERN CALIFORNIA DEVELOPMENT COMPANY, Redlands, Cal., capital stock $15,000,000, has been formed to deal in lands and electric plants, etc. The organizers are A. P. Willoughby, New York; B. W. Brown, Moreno; B. O. Johnson, R. E. Archer and C. E. Fish, Redlands, Cal.

THE PACIFIC UNDERGROUND ELECTRIC RAILWAY COMPANY, San Francisco, Cal., capital stock $100,000, has been formed to deal in patents for underground conduit electric railways, etc. J. J. Scrivner, F. S. Chadbourne, J. F. Burgin, A. Craig, D. B. Richards, San Francisco, Cal., are the incorporators.

THE OSTERHOLM ELECTRIC BELT AND APPLIANCE COMPANY, New Haven, Conn., capital stock $1,000, has been formed to manufacture and sell electric belts and appliances, and to buy and sell other electrical appliances on commission, etc. J. Kallgren, T. O. Osterholm, Jno. Anderson and G. W. Erikson, New Haven, Conn., are the promoters.

Special Correspondence.

NEW YORK NOTES.

Office of The Electrical World,
167-176 Times Building, New York, August 7, 1893.

THE LAW BATTERY COMPANY, 85 John street, seem to have "struck it" in its new carbon porous cup.

MR. DAVID CHALMERS, of A. B. C., narrowly escaped serious injury at Turners, N. Y., where his family is passing the summer, through a collision while out driving.

MR. B. R. DUFF, manager of the Imperial Manufacturing Company, 323 Washington street, is enthusiastic over the merits and success of the Imperial cut-outs.

MR. H. C. ADAMS, president of the Phillips Insulated Wire Company, 39-41 Cortlandt street, New York, has returned from an extended and successful Western trip.

THOS. FALLS STEVENSON, 15 Cortlandt street, New York, formerly with Robt. M. Gilmour, has gone into business for himself as furnisher of asbestos "cement" and hair-felt coverings for boilers and pipes.

THE BAEHR QUICK BREAK SWITCH, manufactured by the Brooklyn Electric Mfg. Company, 286-290 Graham street, Brooklyn, N. Y., judging from recent demands is growing in favor among the electrical fraternity.

THE EXETER DRY BATTERY is meeting with flattering success, if orders can be considered as a criterion. Messrs. E. S. Greeley & Co., 5 and 7 Dey street, New York, report large increasing orders for this well known battery.

CAPTAIN WILLARD L. CANDEE, of the Okonite Company, says that nowithstanding the so-called "hard times" his company's works are pushed to their utmost capacity, in order to fill the orders for this well known company's product.

MR. R. B. COREY, general manager of the Electric Construction and Supply Company, 18 Cortlandt street, New York, manufacturers of the "Ward" arc lamp, has returned to the city, having spent a few days at his home in Elmira, N. Y.

THE "WARD" PROJECTOR, manufactued by the Electric Construction and Supply Company, 18 Cortlandt street, New York, is now to be found upon the best yachts afloat. Simplicity, durability and efficiency comprise its main features.

MR. J. W. GODFREY, general manager of the New York Insulated Wire Company, 15-17 Cortlandt street, has returned from a six months' visit to Chicago. Mr. Godfrey says that his company's exhibit is attracting considerable attention at the Fair grounds.

THE BALL AND WOOD COMPANY, 15 Cortlandt street, New York City, the well known manufacturers of Improved automatic cut-off engines, report having on their books larger orders for engines at present than at any one time during their career. This speaks volumes for the Ball and Wood engines, times considered.

MESSRS. STUCKY & HECK, 23 and 25 N. Railroad avenue, Newark, New Jersey, having had some sixteen years experience with the Weston, United States and Westinghouse companies, have started in business at the above address, and are meeting with most encouraging success. These gentlemen make a specialty of repairing and reconstructing dynamos and motors, and the overhauling and rewinding of armatures of every system.

PITTSBURGH NOTES.

Pittsburgh, Pa., August 3, 1893.

THE PITTSBURGH JOURNALS have been printing stories to the effect that the Edison Electric Company contemplates the removal of all its Eastern works to Fordham, on the McKeesport & Belle Vernon Railroad, a distance of 15 miles from this city.

THE McKEESPORT & WILMERDING ELECTRIC RAILWAY COMPANY has received proposal blanks from the postoffice authorities at Washington, D. C., with a view of getting the electric railway to carry mail matter between McKeesport and Wilmerding.

THE WASHINGTON CARBON COMPANY has shut down its molding and milling departments for a few days to make some imperative repairs and also to take stock. All the other departments are running. The works have been operated night and day for the last year, and they are still behind with their orders.

CHIEF BIGELOW, of the Department of Public Works in this city, has been to the Chicago World's Fair for the purpose of investigating the electric fountains with a view of erecting a similar one in Schenley Park. Miss Julia Marlowe, the famous young actress, has promised to present this fountain to the city of Pittsburgh.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY has just completed the installation of one of the largest isolated electric lighting plants in this city. The plant is owned by the dry goods firm of Joseph Howe & Co. It consists of two 60-kilowatt D. C. dynamos, which furnish current for 240 constant potential arc lights and about 250 incandescent lights. The plant is in charge of Mr. Thompson, who is very proud of the installation, and pronounces it the most perfect and complete isolated plant in Pittsburgh. On each floor is an ornamental switchboard by which the lights on that floor can be regulated. All circuits—there are eight of them—are fitted with the latest safety devices.

WESTERN NOTES.

Branch Office of The Electrical World,
936 Monadnock Building, Chicago, August 5, 1893.

A CORRECTION.—In a note in this department in the last issue a mistake was made in giving the initials of Mr. W. H. McKinlock—C. being substituted for H.

MR. JOHN M. BAKER has been appointed superintendent for the Central Union Telephone Company for the city of Indianapolis, Ind., in place of Mr. C. F. Barnes, transferred. Mr. Baker's headquarters will be in Indianapolis, Ind.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, has recently added to its World's Fair exhibit a lot of 20 finely finished fancy reels of Paranite wire. The reels are stacked in the four corners of the space in such a way as to form four pyramids of reels tapering from very large at the bottom to small at the top. These reels thus serve the double purpose of helping to mark out the space and making an attractive exhibit of Paranite.

MR. J. P. BARRETT, Chief of the Department of Electricity of the World's Columbian Exposition, has issued a circular letter stating that a report embodying in detail the results of the Exhibition, which will be both accurate and in some measure technical in its character, will be issued. In order that it shall be correct, he requests the co-operation of all exhibitors, and desires that each one will prepare and forward to him a detailed description of the things which he has on exhibition, and also an account of any contract work which he may have performed for the Exposition.

Cleveland, O., August 5, 1893.

THE CLEVELAND CITY RAILWAY COMPANY has completed the track of its Rocky River line as far west as Bell avenue. Three hundred and fifty men are at work constructing the railroad. The two tracks on St. Clair street have been relaid to Willson avenue.

JUDGE SMITH'S DECISION in Cincinnati, in the case of the Consolidated Railway Company, was of great interest to Cleveland people, as Cleveland capital was involved in the case. The petition was one brought by abutting property owners, alleging an insufficiency of consents obtained and damage to them should the route be built. The demurrer alleged an insufficiency of facts to constitute a cause of action, and a misjoinder of the parties plaintiff. His honor holds that there is a sufficiency of facts for an action, but there was a misjoinder. He therefore dismissed the petition. The effect of the decision is that in order to have any standing in court at all the Consolidated Railway Company must bring a suit for every square over which the proposed route is to run. The question will then come up as to whether or not the Cleveland people have obtained the majority of consents, not on the entire route, but on each particular square considered by itself. The question of damages to the plaintiffs by reason of the building of the road will also come up for consideration.

Oregon City, Ore., August 1, 1893.

THE PORTLAND-VANCOUVER ELECTRIC LINE is being double tracked its entire length.

THE POINT DEFIANCE, TACOMA & EDISON RAILWAY COMPANY has accepted the additional franchise recently granted by the city of Tacoma for the right to build and operate electric railway lines upon a number of streets.

THE PORTLAND & VANCOUVER ELECTRIC LINE is reported to have made arrangements to operate four electric freight cars over the line of the East Side Railway Company, which does a passenger business between Oregon City and Portland. The distance is 15 miles, and there is room for more competition in carrying freight.

THE NOVEL AND ELABORATE electrical decorations of the "palace of industries," which was erected in Seattle, Wash., in honor of the opening of the Great Northern Railroad, were donated by the Northwest General Electric Company, and the work was done under the supervision of Construction Engineer E. B. Parsons. The Union Electric Company furnished the current.

THE UNITED STATES BATTLESHIP MONTEREY, of the monitor type, which is now in the port of Portland, Ore., carries the following electrical equipment: Three Edison compound M. P. dynamos, each having a capacity of 200 amperes at a potential of 80 volts, making 600 revolutions a minute; four projectors; 334 incandescent lamps, aggregating 6,144 c. p.; besides the usual electrical ventilating fans and minor apparatus.

THE PORTLAND GENERAL ELECTRIC COMPANY now occupies commodious and well lighted offices in its new headquarters building on the west side at Oregon City. The Willamette Falls company also occupies offices in the building. The General company recently uniformed the employees in its Oregon City electric station. Signs have been painted on the building and other improvements made.

CANADIAN NOTES.

Ottawa, August 5, 1893.

CALGARY, N. W. T.—The City Council is calling for tenders for lighting the town by electric light for a period of one to five years. Tenders must state the yearly price per light, per 20 and 30 arc lights of 1,200 c. p. each, all night service, and also the price per light for an additional number required by Council.

OTTAWA, ONT.—The electric apparatus designed by Mr. Thomas Monro, C. E., for operating the lock gates was tried yesterday at Melochville on lock No. 4 of the Beauharnois Canal. It proved a success, the gates being easily opened and closed in about one minute. This will greatly reduce the cost of labor on the canals.

OTTAWA, ONT.—An order in council was passed by the government on Saturday authorizing a contract to be entered into between the Post Office Department and the Ottawa Electric Street Railway Company for the conveyance of the mails between the city post office and the railway stations. The contract has been made and the railway company will commence the work as soon as preparations can be made.

THE OTTAWA (ONT.) PASSENGER RAILWAY COMPANY has a perpetual franchise, but the Ottawa Electric Street Railway franchise is only for 20 years. An agreement for their amalgamation was entered into some months ago, by which the city was to grant the new company a 30-year franchise. The motion was this week made before Chancellor Boyd to quash the by-law approving of the amalgamation. The motion was adjourned until the 8th of September.

OTTAWA, ONT.—Work on the new steam station at the Chaudiere to be erected by the Chaudiere Electric Light Company will commence in a few days. The station will have one of the tallest chimneys in Canada. It will be 120 feet. This extreme height is a safeguard against flying sparks, the station being in the immediate neighborhood of the lumber piles. Scientists say that a spark from pine wood carried up a chimney to the height of 80 feet loses its power for mischief, and the company is going to erect its chimney 40 feet higher still in order to make assurance doubly sure.

OTTAWA, ONT.—Messrs. W. Scott, W. Y. Soper and Dion, of the Chaudiere Electric Light Company, returned on Saturday from Toronto, where they had been placing an order for two tandem compound Wheelock engines of 600 h. p. each and six boilers, with a capacity of 1,300 h. p., for use in the proposed auxiliary steam station of the company. The order was given to the firm of Messrs. Goldie & McCullough, of Galt. The number of the company's lights has increased 75 per cent. during the year, now aggregating between 19,000 and 20,000.

ST. JOHN, N. B.—The Consolidated Electric Company is continually adding new machinery to its plant. This machinery was put in by the Northey Manufacturing Company, of Toronto, and is in many respects different from any other in the Dominion, or perhaps in America. The water is taken from the harbor, where the great rise and fall of the tide makes this a somewhat difficult matter. A pumping station was built on the end of the wharf at the foot of Union street. In this a geared duplex power pump of the Novelty Manufacturing Company's most approved design was placed, weighing about six tons and with a capacity of 1,500 gallons a minute. The large pump has to raise the water by suction and then force it to the station, fully 500 feet away. The lift at low water is a very great one, while at high tide it is not very far. The pump is operated by a 30-h. p. dynamo stationed with the power station machinery. The condenser is what is known as a surface condenser, and is similar in design to those used on ocean steamers, but much larger.

News of the Week.

ELECTRIC LIGHT AND POWER.

BEL AIR, MD., is to have an electric light plant.

TAYLOR, TEX.—The Taylor Electric Light Company will put in additional machinery.

AUBURN, N. Y.—Warden Thayer of Auburn has been ordered to put in a new electric plant.

WASHINGTON, D. C.—The superintendent of street lighting has recommended a large increase in electric arcs.

ELLICOTT CITY, MD.—The Ellicott City Electric Light Company will double the capacity of its plant.

DES MOINES, IOWA.—It is reported that the Fort Wayne Electric Company will make extensive additions to the electric plant it owns in Des Moines.

GAINESVILLE, TEX.—Bids are requested for lighting the city of Gainesville by electricity. Particulars furnished upon application to R. S. Rallins, Mayor.

MOUNT STERLING, KY.—The Mount Sterling Electric Light and Power Company and the Mount Sterling Gas Company have consolidated, and will improve their plants.

MARENGO, ILL.—The town will vote Aug. 14 on the question of issuing bonds for the establishment of a system of water-works and electric lights.

LANCASTER, PA.—An electric light plant will be put in by the Citizens' Electric Light, Heat and Power Company after plans are prepared by C. Emlen Urban.

McCOMB, O.—A project is on foot to organize a company to build a plant for lighting dwellings and residences by electricity. Ewing & Hull will give details.

BUFFALO, N. Y.—The Buffalo & Niagara Falls Electric Light and Power Company will soon call for bids for the construction of its plant. The main building is to be 40 × 80 feet.

GRAVESEND, L. I., expects to make enough from sales to private consumers to defray all running expenses of the electric plant now being installed thus lighting the town without extra taxation.

THE MANCHESTER, N. H., "Union" states that property has been purchased by a syndicate near Gorham, Mass., near the Cascades, for the purpose of erecting an electric plant on a large scale.

BELDING, MO.—The Spencer Electric Light and Power Company, which recently filed articles at Belding, will put in two large dynamos at Smyrna, utilizing the excellent water power at that place.

PLAINFIELD, N. J.—The electric lighting plant here is to be doubled in capacity to meet the increasing demand, and the station will now occupy a full block. Two new engines and additional dynamos will be put in by the company.

HINGHAM, MASS.—Fred M. Hersey, Morris F. Whiton, Sumner Cushing and George W. Burr are the committee in the matter of the proposed electric lighting plant for Hingham, Mass., to pay for which $50,000 in bonds will be issued.

JOLIET, ILL.—The penitentiary commissioners and Warden Allen have rejected all electric light bids for the electric plant at the prison, and will make arrangements for new bids, although it is thought that they will not advertise for bids again.

MOUNT CARROLL, ILL.—A petition praying the City Council to call a special election to allow the people to express whether or not it is their desire to bond the city to build an electric light plant is being circulated and everybody is signing it.

CLEVELAND, TENN.—A local syndicate has been granted a franchise for an electric light plant in Cleveland. While the city has made no definite arrangements to be lighted by electricity, still the plant is to be erected, trusting for a general patronage.

NORTHAMPTON, MASS.—The Electric Lighting Company will put up a new plant having a capacity of 4,000 incandescent lights and 220 arc lights. It is stated that the new machinery will include a 500-h. p. compound condensing engine, three vertical boilers and several dynamos.

LUDLOW, KY.—Sealed proposals will be received until Aug. 17 for the electric lighting of the city in accordance with amended specifications, which provide for an exclusive grant for ten years to the operating company. Specifications are on file in the office of City Engineer Weaver, Ludlow, Ky.

STILLWATER, MINN.—In consequence of a failure of the City Council to agree with the electric light company as to the value of street lighting, the lights throughout the entire city, 263 in number, have been shut off. The price was $22 a year for incandescent and $8 per month for arc lights, or about $7,000 a year.

LINWOOD, O.—Sealed proposals will be received until Aug. 22 for the work required in constructing an electric light plant for the village; for furnishing and erecting boilers and engines for electric light plant; for furnishing dynamos and apparatus for the production and operation of arc and incandescent lights. J. L. McClure, president.

WINDSOR LOCKS, CONN.—The directors of the Windsor Locks Electric Lighting Company, at a meeting held in the office of E. B. Daily, have decided to borrow money with which to increase the capacity of their plant. A new 150-h. p. boiler and 100-h. p. engine will be put in, the dynamos increased from their present capacity of 1,500 lamps to 3,000 lamps, and other improvements will also be made.

THE ELECTRIC RAILWAY.

MERIDIAN, MISS., is to have electric cars.

CAMBRIDGE, MASS., will have another electric line.

ELGIN, DUNDEE AND CARPENTERSVILLE, ILL., are to be united by an electric line.

CONEY ISLAND, N. Y.—Electric railway franchises have been asked for several lines in Gravesend.

WASHINGTON, D. C.—It is reported that a strong attempt will be made to introduce the trolley for street railways.

FORT WORTH, TEX.—It is reported that work will commence on the Fort Worth & Dallas electric road before Sept. 1.

YPSILANTI, MICH.—Sidney Rathforn has sold the equipment and franchise of the Ypsilanti horse car line to James L. Hill.

SPERRYVILLE, VA.—C. C. Smoot & Sons are interested in a project to build an electric railway from Culpeper to Sperryville, a distance of 20 miles.

GREEN SPRING, MO.—Sealed proposals will be received until Aug. 14 for the construction and operation of Street Railway Route No. 1. J. B. Maule, City Clerk.

HUDSON, N. Y.—The Hudson Electric Railway Company, through President H. McGonogal, has applied for leave to extend its road within the limits to the northerly line of the city.

MONTGOMERY, PA.—The Montgomery Passenger Railway Co. has offered a bond guaranteeing the faithful performance of their contract to build a road from Norristown to Barren Hill.

SANDUSKY, O.—Work has stopped on the Sandusky, Milan & Norwalk electric road on account of the inability of the directors to obtain funds. They expected to float bonds to the amount of $60,000, but are unable at present to sell them.

BEAVER MEADOW, PA.—The work of building the Beaver Meadow, Hazleton & Mahanoy City Electric Railway, one of the longest electric railways in the State, will again be prosecuted. The road will run from Beaver Meadow to Mahanoy City, and thence probably to Pottsville, a distance of 40 miles.

PATERSON, N. J.—Among the directors of the New Jersey Improvement Company, which proposes to build a 40-mile trolley road from here to New Brunswick, are Jacob L. Stadleman, of Bala, Pa., and Chas. E. W. Smith, of Morristown. R. F. Hill, of 58 Ann street, New York, is president.

NASHVILLE, TENN.—The Nashville Railway and Electric Power Company of this city applied to the Secretary of State for an amendment to its charter to enable it to construct and operate a line of street railway on Cherry street and Spruce street, and there connecting with the line of railway heretofore built and operated by the company.

BAYONNE, N. J.—A petition is being circulated among the business men to induce Council to grant an electric franchise to the Bayonne City Rapid Transit Company. The Jersey City & Bergen R. R. Co. has a line along Avenue C, one block from Avenue D, along which the Bayonne City Rapid Transit Company proposes to build. The latter company is an applicant for permission to substitute the trolley system for horses as motive power.

LEGAL NOTES.

RIGHT OF ABUTTING OWNERS TO INJUNCTION.—Where a street is already encumbered with two street railroad tracks with a line of poles between them, and in addition with many electric light, telegraph and telephone poles on both sides of the street, an injunction will issue in favor of abutting owners against the construction of a third track and additional poles, though authorized by the city council, since such a track is a special injury to the property rights of the abutters, it appearing that the tracks already in the street afford ample facilities to run all cars necessary for public convenience. (Dooley Block versus Salt Lake Rapid Transit Company, Supreme Court of Utah. 33 Pac. Rep., 230.)

DAMAGES FOR BREACH OF CONTRACT.—Where an electric company contracted with one to solicit orders for its electric protective system, and furnish all necessary appliances for use in connection with such offices as might be thereafter designated, the company agreeing to maintain such apparatus, and serve customers according to the contract between the solicitors and such customers, and to receive as compensation 50 per cent. of the rentals—the contract was for three years—where the solicitors, after procuring several customers, refused to go on with the contract, though the profits were wholly prospective, the company were entitled to damages. (Ramsey versus Holmes Elec. Co., Supreme Court of Wis. 55 N. W. Rep. 91.)

EFFECT OF WORDS "HORSE RAILROAD TRACK OR TRACKS."—The words "horse railroad track or tracks," when used in a city ordinance, must be taken as descriptive of the road to be constructed. and not of the motive power to be used. Railways in the streets of cities, laid to conform with the grade of the streets, and properly known as "street surface railroads," had by common usage been designated as "horse railroads," from the fact that they were for a long time operated exclusively by horses, and "horse railroads" and "street surface railroads" have come to be convertible terms. Therefore where a street car company is authorized to lay "horse railroad track or tracks" along certain streets they are not restricted to the use of horse power in propelling their cars upon such tracks, and are at liberty to use the electric trolley system for that purpose. Therefore one owning property along the line of such railroad has no right to cut the company's wire in front of his property, upon the ground that they had no right to adopt electricity as a motive power. (Paterson Railway Co. versus Grundy. Court of Chancery of N. J. 26 At. Rep., 788.)

PERSONAL NOTES.

GERMANY will be represented at the International Electrical Congress at Chicago by the following delegates: Drs. von Helmholtz, Lummer, Buddle, Prof. Voit, of the Polytechnic at Munich, and Privy Councillor Schroeder, of the Patent Office.

E. HOSPITALIER, editor of "L'Industrie Electrique," Paris, who is now in Chicago as one of the French commissioners to the Electrical Congress, is an indefatigable worker. He is not content with familiarizing himself with the electrical display at the World's Fair, but intends, before his return, to study the mechanical features as well. Although this is M. Hospitalier's first visit to America, he shows a marked familiarity with American electrical practice which astonishes Americans with whom he converses. His chief criticism of the Fair is that it is too large, and he regrets that his countrymen are not more fully represented by their work. He accords to America the first place in the practical application of electricity in the arts, and expects to find much of interest to communicate to his countrymen abroad.

PROF. W. E. AYRTON is a familiar figure in Electricity Building, where he is busily engaged as one of the judges of exhibits. While one would not mistake his nationality, he has the nervous activity of the typical New England Yankee, to which we are pleased to attribute a part, at least, of that unceasing energy that has made his name so famous. Prof. Ayrton is equipping in the northwest corner of Electricity Building a small but complete testing laboratory, where many of the tests which will be involved in determining the awards will be made. He is also one of the British commissioners to the Electrical Congress, and while too busy at this time to talk very freely of the measures that will be brought up still evinces a lively interest in them. He announces that Mr. Alexander Siemens will sail shortly for this country to be in attendance on the Congress.

MR. JOHN STEPHENSON, the well known car builder, died at his residence in New Rochelle, on Aug. 1. Mr. Stephenson was born on July 4, 1809, near Armagh, Ireland. He came to New York in 1811, and was educated at the Wesleyan Seminary, it being the intention of his father that he should pursue a mercantile life. Developing a mechanical turn of mind, at the age of 17 he was apprenticed to a coachmaker. In 1831, after his apprenticeship was completed, Abram Brower, proprietor of the Broadway omnibus lines, invited him to open a shop at 667 Broadway, and on May 1 Mr. Stephenson began business there on his own account. He designed the first vehicle known in New York as an omnibus, and later the New York & Harlem Railroad arranged with him to construct a car of entirely original design. This car has become historical as the first street car ever used. Mr. Stephenson received a patent on the car signed by President Andrew Jackson and members of the Cabinet. In 1843 he purchased the site of the present works in Twenty-seventh street, where his business of building cars has rapidly increased until at the present day his name is known in almost every civilized country.

MISCELLANEOUS NOTES.

NEW WILMINGTON, PA.—Ground has been broken for the new Science Hall at Westminster College; the electrical laboratory will be in the basement, and will be fitted up at a cost of $5,000. Rev. Geo. R. Ferguson, president.

ELECTRIC FOUNTAINS.—The Fifth Avenue and Duquesne traction companies have donated an electric fountain for Schenley Park, Allegheny, Pa., which will cost $20,000. The Franklin Electrical Company, of Kansas City, Mo., has been awarded a contract for an electrical fountain at Lynn, Mass.

FAURE PATENT SUIT.—In the United States Circuit Court at Trenton, N. J., on Aug. 1, Judge Green dismissed the suit of the Accumulator Company, of Newark, N. J., against the Consolidated Electric Storage Company, of Camden, for want of jurisdiction. This suit was based on the Faure patent.

THOS. A. EDISON sent the following note written on a card to a reporter who went to see him in regard to the partial shut-down of the Edison phonograph works: "The phonograph works have been shut down because we have nearly completed all the orders on hand, and the proprietor thereof, seeing that the country had resolved itself into a national lunatic asylum, decided to wait until the wave subsided somewhat.

"EDISON."

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY has issued a well-printed and handsomely illustrated 40-page pamphlet, containing an account of the foundation, character and equipment of the Institute. The pamphlet was prepared in connection with the World's Columbian Exhibition, and the large number of half-tones, giving an excellent idea of the equipment of this fine school, will doubtless be appreciated by the many foreign technical visitors to the Fair, and will further extend its fame in the United States.

NEWSPAPER MISREPRESENTATION.—The "Mail and Express," of New York, published a garbled report of the injunction proceedings before Judge Lacombe on Aug. 1, in which it was stated that the injunction was denied, and a quotation made in court severely reflecting on the Edison company was represented as part of Judge Lacombe's opinion. It is understood that the matter narrowly escaped being brought officially to the attention of Judge Lacombe.

THE TRADE PRESS CONGRESS OF THE WORLD'S CONGRESS AUXILIARY OF THE COLUMBIAN EXPOSITION will meet in the Memorial Art Palace in Chicago on Aug. 14, 1893. It is expected that many of the leading trade journals of the country will be represented, and a programme has been prepared to include papers and discussions upon subjects which are of great interest to every publisher of class papers. In addition to the literary features of the programme, a series of entertainments, etc., has been arranged which will include visits to the World's Fair, receptions by the Chicago Publishers' Association at the Auditorium Hotel by Maj. Moses P. Handy, Chief of the Department of Publicity and Promotion of the World's Columbian Exposition, etc., etc. The first session will be held on Monday evening, Aug. 14, at the Memorial Art Palace, Michigan avenue and Adams street, at which time preliminary organization and registration, etc., will be made. There will also be sessions on Tuesday and Wednesday morning, and on Thursday morning and evening.

THE WESTINGHOUSE CHARGES.—Solicitors for the General Electric Company filed in Salem on Aug. 1 the answers to the bill in equity filed against the General Electric Company, the Thomson-Houston Electric Company, and E. Wilbur Rice, Jr., and Walter H. Knight, in the Supreme Judicial Court at Salem, May 6, in which the plaintiff charges the defendants with bribery and instigation of theft in securing plans and blueprints from the Westinghouse company, that the defendants might take advantage of the plaintiff in competition, and charging them with concealment and removing from the offices of the Thomson-Houston Electric Company plans and prints that were in possession of the defendants in order that the said property might not be recovered on a writ of replevin served May 5. The answers are three in number—one for each defendant—and deny all charges, although admitting that in the possession of the company there may have been various prints of apparatus manufactured by the plaintiffs, but secured in the ordinary course of business, without wrongful action on the part of the defendants.

Trade and Industrial Notes.

J. GRANT HIGH & CO., 123 North Third street, Philadelphia, have issued price list No. 2 of their single, double and triple throw knife switches.

S. K. WOLFF & CO., Wevelinghoven, Germany, send us a catalogue of the large line of porcelains manufactured by them, which includes numerous forms for electrical use.

J. W. PENFIELD, & SON, Willoughby, O., have published a 16-page catalogue of the Imperial Friction Clutches, which can be commended as a model in artistic and sensible catalogue making.

THE ANSONIA ELECTRIC COMPANY, Chicago, Ill., has issued several new sheets of illustrations of electric and combination fixtures for the convenient binding portfolio which they present to those of the trade interested.

MAKING THE CIRCUIT OF THE GLOBE.—The Worthington pumping engines are to be used for the water supply of the city of Osaka, Japan. These machines have already worked their way as far east as China, so that this practically completes the circuit of the earth.

THE BRYANT ELECTRIC COMPANY, OF BRIDGEPORT, CONN., denies that it has shut down permanently, and says that the works are merely closed for two weeks on account of the large stock of goods that has accumulated. Work will be resumed at the end of the two weeks.

THE CLEVELAND ELECTRIC RAILWAY COMPANY, of Cleveland, O., has recently equipped seven new boilers at its Cedar Avenue station with No. 5 Reliance Safety Water Columns, made by the Reliance Gauge Company, of Cleveland, O., which makes 21 columns in use at that plant and 34 columns now in use in the various power stations of that company, some of which have been in use for over five years. Such orders as these are the best possible indorsement for any appliance.

THE NEW JERSEY LAMP AND BRONZE WORKS, New Brunswick, N. J. (New York office, 44 Murray street), has issued a beautiful catalogue of gas and electric fixtures which is a chef d'oeuvre of its kind. The illustrations are in colors on highly finished paper, and even the business announcements partake of the artistic nature that everywhere characterizes the book, as well as the fixtures illustrated. This only seems natural, however, when we learn that the catalogue was engraved, printed and bound in the company's own printing office at its works.

THE HELIOS ELECTRIC COMPANY, 1310 Filbert street, Philadelphia, have had phenomenal success in the introduction of the Helios alternating current arc lamp, over 4,000 having been sold since December, 1892, and the addition of the Spencer Economy coil will undoubtedly accelerate this rate. Among some of the cities where large sales of their lamps have been made are the following: New York, 1,000 lamps; St. Louis, 500 lamps; Philadelphia, 500 lamps; World's Columbian Exposition, 502 lamps; Lancaster, Pa., 100 lamps, and many sales have been made of smaller numbers of lamps.

MR. MORTIMER NORDEN, 136 Liberty street, New York, has succeeded the H. N. H. Electric Company, formerly composed of Messrs. Arthur Hammerschlag, Mortimer Norden and Newton Harrison. Mr. Norden will continue the business, and during the past few days has closed the following orders: The complete electric light plant for Everard's brewery, 134th street, between Madison and Fifth avenues, New York City; complete installation of electric light plant for the Philadelphia fire department's fire boat, "Edwin S. Stuart"; 100-light plant for the Galvanotype Engraving Company, 18 Rose street, New York City; 60-light plant for Messrs. Freithal, Elting & Co., 938 Third avenue, New York City.

MR J. W. GODFREY, general manager of the New York Insulated Wire Company, returned to the city last week from Chicago, where some time since he went to look after the company's extensive interests in connection with the World's Fair, which comprises the wiring of the incandescent work in all World's Fair buildings, the wire used in this installation being the "Grimshaw" white core. About 20,000,000 feet was used in the various buildings, supplying about 90,000 lamps. From all reports it would seem that the New York Insulated Wire Company should feel highly encouraged with the business which it is doing in the West. Mr. Godfrey expressed himself enthusiastically regarding the company's Western interests, which are now solely in the hands of Mr. J. B. Olsen, who recently left New York to take charge of the company's Chicago office.

PAGE BELTS AT THE WORLD'S FAIR.—During the months of May and June the power for the Intramural Railway was all furnished by a single generator which was driven by a 48-inch double belt of the Page Belting Company's manufacture, running at a speed of 4,000 ft. per minute. The power required for the operation of the trains on the Intramural Railway has often been as high as 1,000 h. p. and 1,200 h. p., while the belt at the speed named was intended to transmit only 750 h. p.; this is the first large belt made in the new works of the Page Belting Company at Concord, N. H., and its record is very satisfactory. The Page company is also very busy at its works, having recently received an order for a complete outfit of belting for the Union Mills, Moosup, Conn., and one for the Platte River Paper Company, of Denver, Colo., which includes one 42-inch and two 28-inch double belts. This company has also shipped recently to the Duluth Street Railway at Duluth, Minn., a three-ply 48-inch belt 166 feet long.

THE FERRACUTE MACHINE COMPANY, of Bridgeton, N. J., have a large exhibit of their presses, spinning lathes and other sheet-metal machinery, as well as a number of dies, at the Columbian Exposition. They are located in the centre of Machinery Hall Annex, Columns I J, 42. Their space is about 30 feet square, and they have a small auxiliary space on the centre aisle also. They show two large drawing presses, a large double-crank press suitable for armature disc work, three of their new style of C presses, which are especially adapted for electrical work, two punching presses, and a number of foot, screw and drop presses, two spinning lathes, beaders, threaders, crimpers, etc., in operation daily. They are manufacturing a number of small goods in aluminium brass and tin which illustrate the work done in their presses. All of these presses are from latest designs, and have a number of improvements in the way of new clutches and adjustments, etc. The tools are driven from a line of shafting of their own, and an upright engine gives the necessary motive power. Mr. Edmund Hoffman, foreman of the press department, is in charge, and is glad to welcome any one interested in the metal-working business, at any time. They have a number of dies in operation which are of very great interest, in the manufacture of cups, plates, pans and small fancy goods. They also show on their wall space a great variety of articles made in their presses and dies which are interesting.

Business Notice.

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

UNITED STATES PATENTS ISSUED JULY 11, 1893.

[IN CHARGE OF W. A. ROSENBAUM, 171 TIMES BLDG., N. Y.]

501,485. INCANDESCENT LAMP SOCKET; H. P. Ball, Schenectady, N. Y. Application filed Aug. 3, 1892. A socket, shell or casing, a socket body consisting of discs or plates having holes in them, these holes being adapted to receive conductors and so arranged in the several discs as to be out of line with each other when the discs or plates are put together in the socket.

501,488. REGULATING ELECTRIC LOCOMOTIVES; J. B. Blood, Lynn, Mass. Application filed Nov. 16, 1892. The combination of a number of electric motors and a resistance, with a switch arranged to gradually cut out resistance when thrown from open circuit position, and by a still further movement to short-circuit a motor after the resistance is cut out.

501,491. INCANDESCENT ELECTRIC LAMP; E. E. Cary, Boston, Mass. Application filed April 6, 1893. In this invention radiators are attached to the leading-in wires, these radiators having slots by means of which they are secured to the wires.

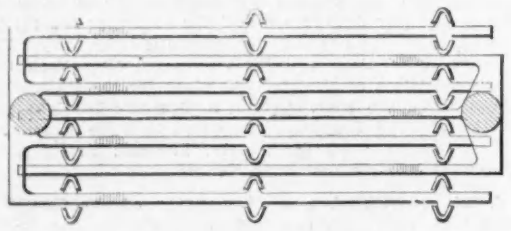
501,502. INCANDESCENT LAMP FIXTURE; A. T. Gifford, Hopedale, Mass. Application filed Nov. 28, 1890. A rigid incandescent lamp stem, provided at one end with a ball having a diametrical wire passage for the circuit wires of the lamp, combined with a separable clamp composed of narrow rings having concavities to embrace the ball at or near its equatorial part and leave the poles of the ball uncovered, and means to hold the parts of the clamp together and cause the clamp to embrace the ball by a measured friction.

501,519. METHOD OF AND APPARATUS FOR EXTINGUISHING FIRES; J. G. Lorrain, London, England. Application filed March 18, 1892. This invention consists of a valve and a fusible connection of conducting material for holding the valve in its normal position, a source of electricity and a normally open circuit leading therefrom and including the valve connection, and thermal or hand contacts for controlling the circuit.

501,524. SURGICAL LAMP; Wm. G. Morgan, Fryeburg, Me. Application filed July 27, 1892. The combination in an electrical surgical lamp of a small electric incandescent lamp, a transparent thimble, a channeled stock and tubular terminals.

501,529. INCANDESCENT ELECTRIC LAMP; W. E. Nickerson, Cambridge, and E. E. Cary, Boston, Mass. Application filed March 29, 1893. The combination of a flexible non-conducting disc of non-volatile substance having a laminated structure and glass-like reflecting surface, this disc being located within the neck of the lamp and forming part of the inclosing wall of the vacuum chamber and supporting a plug of fusible cement by which the lamp is rendered airtight; and a globe with a neck adapted to retain this disc and cement.

501,530. INCANDESCENT ELECTRIC LAMP; W. E. Nickerson, Cambridge, and E. E. Cary, Boston, Mass. Application filed March 31, 1893. The combination of a glass globe having a neck adapted to be closed airtight by fusible cement; with a sealing of fusible cement, composed of rosin chemically combined with lime and a suitable oil.



No. 501,723.—SECONDARY BATTERY.

501,531. INCANDESCENT ELECTRIC LAMP; W. E. Nickerson, Cambridge, Mass. Application filed April 6, 1893. The combination of a glass globe having a neck adapted to be closed airtight by a fusible cement, the materials of this cement having been freed from volatile matter by being exposed to a much reduced atmospheric pressure at a high temperature.

501,532. DEVICE FOR REGULATING CONSTANT CURRENT DYNAMO ELECTRIC MACHINES; Olof Offrell, Middletown, Conn. Application filed Dec. 12, 1892. This device consists of a curved iron plate parallel with the armature, and mounted to move concentrically therewith.

501,540. ELECTRICAL MUSICAL INSTRUMENT; P. E. Singer, London, England. Application filed June 16, 1892. In a keyed musical instrument in which electromagnets are used to create or maintain the vibration of the strings or other sonorous bodies employed, rotary commutators, one for each note in the gamut, constructed and arranged to make and break the circuits of their respective electromagnets at a rate synchronous with, or having musical relation to, the vibrations in the strings or other bodies, requisite to produce and sustain the notes, the keys, when they are depressed, and are putting the magnets in connection with the source of electricity. (See illustration.)

501,541. ELECTRICAL MUSICAL INSTRUMENT; P. E. Singer, London, England. Application filed June 16, 1892. In a keyed musical instrument in which the strings or other sonorous bodies are sounded, or their sound is maintained, by electromagnets, the combination therewith of a vibrating commutator tuned in musical relation to the note it represents, and placed between two pairs or terminals belonging to the circuit in which the electromagnet of the sounding body is situated, this commutator serving, by each complete vibration, twice to make and break the circuit of that electromagnet, and correspondingly control the vibrations of its strings or other sounding body, the commutator magnet being excited by a current separate from that which excites the electromagnet of the sounding body.

501,542. ELECTRICAL MUSICAL INSTRUMENT; P. E. Singer, London, England. Application filed June 17, 1892. In a keyed musical instrument the combination with a string or other sounding body of an electric circuit, a circuit closer therefor, a magnet in the circuit for attracting the string or other body, an elastic contact-maker controlling the circuit through the magnet and through it the vibrations of the string or other body, and mechanical connections between the string or other body and the circuit maker and breaker for vibrating the latter as the string or other body vibrates.

501,543. ELECTRICAL MUSICAL INSTRUMENT; P. E. Singer, London, England. Application filed Feb. 21, 1893. In a stringed musical instrument actuated by electricity under the control of finger keys, a yielding or elastic contact maker, consisting of granules, discs or pellets of carbon or equivalent material, contained within and supported by a tube or chamber below the finger key and connected with the battery wire, the carbon "filling" of this tube being exposed to electric contact with a metallic plate or button carried by the overlying finger key.

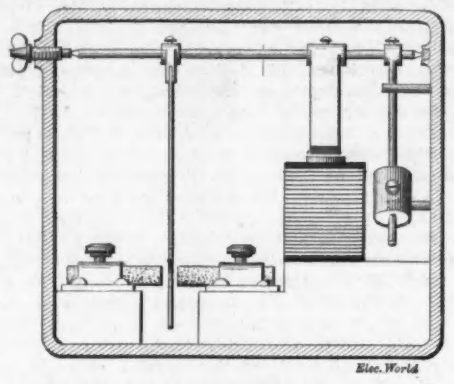
501,546. AUTOMATIC CHAIN WELDING MACHINE; Elihu Thomson, Swampscott, and C. E. Harthan, Lynn, Mass. Application filed Jan. 8, 1891. The combination with heating electrodes of a step by step feeder in line with the electrodes for feeding the work into and out of position in the electric circuit between the electrodes.

501,547. SHAPING AND SPINNING METALS BY ELECTRICITY; Elihu Thomson, Swampscott, Mass. Application filed Jan. 8, 1891. This consists in passing a current of electricity through the material to soften it, and applying pressure to spin the material into the desired form.

501,550. ELECTRIC BODY BATTERY; H. C. Wagner, Cleveland, O. Application filed Sept. 1, 1892. In an electric body belt a series of cells, consisting of a zinc strip having its ends folded back openly on itself, a copper strip also having its ends folded back openly on itself, and interwoven crosswise with the zinc strip, and having an absorbent material interposed between the strips, and a wire loop attached to the zinc strip and linked to the copper strip of the adjacent cell.

501,558. ELECTRO-MEDICAL APPARATUS; J. A. Cabot, Cincinnati, O. Application filed Aug. 24, 1892. This comprises a motor shaft armed with a series of wheels adapted to break a primary current at different intervals, a brush and connections uniting either one of these circuit breakers with a primary coil, a pair of insulated contact rings having brushes and connections uniting them respectively with a low tension and high tension coil, a commutator consisting of two distinct series of insulated segments communicating with the rings, and a pair of brushes bearing against the segments.

501,565. GAS LIGHTING APPARATUS; Gustav Goerldt, Kitzingen, Germany. Application filed Dec. 10, 1892. The combination in a gas lighting apparatus of electromagnets, an armature, a valve suspended to a rod, a bell, and a vertical lever, forming the armature, and provided with a catch.



No. 501,708.—LIGHTNING ARRESTER.

501,580. ELECTRIC LAMP SOCKET; Gustave Sachs, St. Louis, Mo. Application filed April 27, 1893. This device has a centre contact piece insulated from the casing by a non-conducting plate and provided with two wires leading from this centre contact piece, one passing out of the casing and the other through the socket of the lamp, and two wires from the contact end of the casing, of which one leads out through the casing and the other to the lamp through the socket base.

501,589. ELECTRICAL MEASURING INSTRUMENT; R. M. Hunter, Philadelphia, Pa. Application filed Feb. 10, 1893. The combination of a pivoted pointer, an expansion wire connected to move the pointer and having portions of its length arranged out of a straight line, terminals connected with the expansion wire at points distantly removed, and a curved compensating support of glass or vitreous material for holding the expansion wire in position.

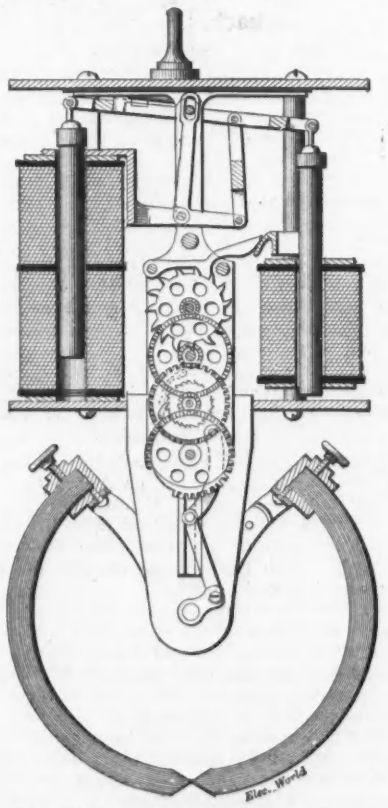
501,600. EARPHONE ATTACHMENT; C. W. Farr, Chicago, Ill. Application filed April 14, 1893. The combination of a band arranged to be fitted over the head of the receiving instrument, a bulb adapted to encircle the body of the instrument, and a pipe or tube connecting the band and bulb and having a suction valve therein.

501,610. TRANSMITTER FOR TELEPHONES; J. A. Brown, Moline, Ill. Application filed April 26, 1893. This invention comprises a diaphragm located between two magnets and placed outside of the magnetic field, and connected with an armature common to two magnets in circuit.

501,631. ELECTRIC CIRCUIT CONNECTION FOR SIGNALING OR TELEPHONE BOXES; J. E. Smith, New York. Application filed Feb. 24, 1893. This comprises fire alarm signal boxes and signaling devices and two metallic circuits leading to the same, of a telephone instrument and circuit connections at each signal box for introducing the telephone at one signal box into the metallic circuit that passes to the signaling devices at a distant signaling box.

501,653. AUTOMATIC FIRE ALARM; Jos. Havard, New Bedford, Mass. Application filed May 10, 1893. This consists of an automatic circuit closer, consisting of a box composed of non-conducting material having slots in its sides, and provided with a projection; strips of spring metal secured to the sides of the box and extending through the slots to the interior of the box where they normally come in contact by the spring of the metal; a wire connected with one of the springs, extending to the outside of the box and over the projection, and provided with a loop whereby the strips may be held out of contact by fusible metal, wax or cord.

501,676. ELECTRIC RAILWAY CONDUIT; I. J. Cook, Newark, N. J. Application filed Aug. 23, 1892. An electric conduit combining therein a sleeper or stringer, means for supporting it whereby it may be removed to afford access to the conduit, and a track rail supported on the sleeper.



No. 501,884.—ELECTRIC ARC LAMP.

501,701. ELECTRIC CONTROLLING AND LOCKING MECHANISM FOR RAILWAY SWITCHES AND SIGNALS; C. M. Wilder, Cincinnati, O. Application filed Oct. 17, 1892. In an electrical interlocking system, a switch motor circuit, one or more switch indicator circuits, and one or more signal and switch circuits.

501,707. ELECTRIC SWITCH; W. H. Dingle and J. M. Urquhart, London, England. Application filed April 23, 1892. In an electric switch, the combination of a rocking contact lever and a detent lever interlocking therewith, a circuit-making plunger acting on this contact lever, and a circuit-breaking plunger engaging the detent lever and a spring arranged between the circuit-breaking plunger and the contact lever.

501,708. LIGHTNING ARRESTER; F. H. Doane, New York. Application filed May 31, 1893. The combination of a pair of arcing points, two circuits leading to ground from one of the points, an electromagnet included in one of the circuits, and a diaphragm of non-conducting material arranged to be interposed between the arcing points of the magnet. (See illustration.)

501,723. SECONDARY BATTERY; Frank King, London, England. Application filed March 16, 1893. A plate for secondary batteries having projections extending out from the surface thereof, and combined with continuous strips of insulating and acid-resisting material placed over the projections. (See illustration.)

501,755. METHOD OF FORMING COAL CUTTERS; Foree Bain, Chicago, Ill. Application filed May 31, 1892. This method consists in first uniting a piece of iridium to form the point to a suitable metal holder through the medium of an electric circuit, and then uniting the iridium point to the body of the cutting tool through the medium of an electric current, and subsequently separating the metal holder from the iridium point.

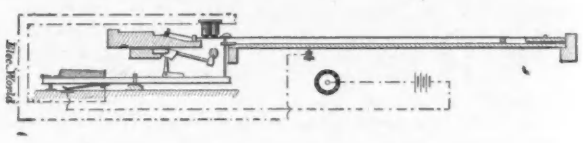
501,757. ELECTRIC ARC LAMP; S. Bergmann, New York. Application filed Jan. 10, 1893. The combination with the escaping mechanism of a loosely mounted arresting lever connected with the armature of the electromagnets.

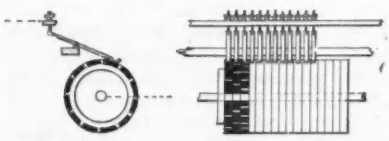
501,758. CARBON HOLDER FOR ELECTRIC ARC LAMPS; S. Bergmann, New York. Application filed March 20, 1893. A rack bar, a ring frictionally secured to it, a yoke frictionally held to the ring, this yoke having a downwardly bent portion shaped to act as a member of the carbon holder clamping means.

501,768. ELECTRIC ARC LAMP; J. T. Dempster, Summit, N. J. Application filed Feb. 13, 1893. The combination of a rack bar provided with an insulating block having an inclined surface, of the shunt electromagnets, a switch lever loosely pivoted and electrically connected with the shunt electromagnets, and a spring for holding the switch lever in contact with the rack bar.

501,777. BURGLAR ALARM; C. J. Fisher, Chicago, Ill. Application filed April 5, 1893. This consists of a base plate of a non-conducting material, conducting plates adapted as conductors of electricity secured on the upper face of the base plate, a second set of conducting plates located on the under face of the base, one in connection with each of the upper plates, a spring arm in electrical engagement with one of the lower plates, a guide device through which the spring arm passes in engagement with the second under plate, binding posts connected with the upper plates, and a knob of an elastic or yielding material located in the outer end of the spring arm.

501,825. METHOD OF AND APPARATUS FOR HEATING, WELDING OR WORKING METALS ELECTRICALLY; C. L. Coffin, Detroit, Mich. Application filed Feb. 9, 1893. In an apparatus for electrically heating and welding by means of an electric arc, the combination with two concentric electrodes, of a magnet for directing and steadying the arc.





No. 501,540.—ELECTRICAL MUSICAL INSTRUMENT.

501,842. ELECTRIC MOTOR; M. W. Long, Harrisburg, Pa. Application filed March 23, 1891. In combination with a series of field magnets, each of opposite polarity from the next, the armature having all the poles at each end of like polarity, the commutator rings having magnet coils connected thereto, the commutator plates, and two brushes contacting with the plates.

501,847. MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES; C. E. Scribner, Chicago, Ill. Application filed July 30, 1892. The combination with an annunciator having an electromagnet, an indicator, and mechanism adapted to actuate the indicator, when the electromagnet is intermittently energized by a pulsating current, but adapted to retain the indicator inoperative when the electromagnet is continuously energized or de-energized, of a circuit containing the electromagnet and a source of pulsating current, a source of continuous current, and means for connecting the same in the circuit.

501,849. ELECTRIC BELT; N. H. Standish, Evansville, Wis. Application filed Oct. 24, 1892. In an electric belt a battery composed of a central plate of zinc, a pocket of felt, and an outer cylinder of copper, the zinc plate being bent or folded on the felt strip which forms the pocket, the free end of the strip being wrapped around the bent plate, and a connecting wire soldered to the upper and lower ends of the zinc plate.

501,859. METHOD OF PREPARING CABLES FOR MULTIPLE SWITCHBOARDS; O. A. Bell, Brooklyn, N. Y. Application filed Nov. 7, 1892. The method of preparing cable connections, which consists in removing the serving from a portion of a cable, separating the exposed portion into two parts connected by wires, leaving these parts at different points, and severing the connecting wires midway between these parts, whereby two pieces of cable are formed with wires of equal length projecting at different points along the extremities.

501,861. ELECTRIC BELT; A. D. Berliner, Rock Island, Ill. Application filed June 23, 1892. The combination with a battery of an electric belt, of contacts having arms passed through one of the folds of the fabric of the belt, the links having one end bent around the arms of the contact, and another link connected to the battery pole, the one link being carried through the other link and then back on the wire composing the former link, so as to form a reliable electrical connection between the contacts and the adjoining battery cell.

501,884. ELECTRIC ARC LAMP; W. H. Klees, Susquehanna, Pa. Application filed June 10, 1892. The combination with a support supplied with dependent supporting pieces, a slideway upon each piece, two carbon holders pivotally secured in the lower ends of the pieces, the inner end of the shaft of each holder being provided with a crank, a train of gearing, a jointed connection between the cranks and the last wheel of the train of gearing, the ends of the pivot of which connection engage with the slideway of the depending pieces, and means for regulating the movement of the train of gearing. (See illustration.)

501,905. ELECTRIC FIRE ALARM; Chas. Bernhardf, Chicago, Ill. Application filed Oct. 3, 1892. In a fire alarm system, the combination with a series of wires provided with thermostats forming parts of a closed electric circuit, of a dial, a series of contact plates mounted thereon and separated by suitable spaces, a hand mounted on the dial and adapted to bridge over the spaces between the contact plates, loops joining the ends of the wires of the series and passing through the contact plates, means for rotating the hand, and an electromagnet lying in the circuit and adapted to prevent rotation of the hand when the circuit is closed, but to permit such rotation when the circuit is broken.

Copies of the specifications and drawings complete of any patent mentioned in this record—or of any other patent issued since 1876 can be had for 25 cents. Give date and number of patent desired and address The W. J. Johnston Co., Ltd., Times Building, N. Y.